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THE BINET SCALE AND THE DEAF CHILD.

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An attempt was made by the writers to see how far the Binet-Simon Scale could be applied to test the mentality of the deaf child. The purpose was not primarily a practical one. We did not test the children with a view to diagnosing such feeble-mindedness as might exist among them. Our aim was purely theoretical, in as much as we wished to determine to what extent the present Binet-Simon Scale (Goddard's revision) might be used with the deaf child; to what extent it might be used for practical purposes hereafter.

No published account of any such work has so far come within the writers' notice. The inadequacy of the scale is felt by Healy,[1] when he says: "It (the Binet Scale) helps very little where the language factor is a barrier, either on account of foreign parentage or insufficient schooling, and with uneducated deaf and dumb children." The scale is also referred to in an article in the Volta Review,[2] in which the Binet Scale as printed by Huey[3] is there reprinted with a few introductory remarks. The writer says: "While the following

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[1] HEALY AND FERNALD. *Tests for Practical Mental Classification.* Psych. Rev. Mono., Vol. 13, No. 2.

[2] *Binet's Scale for Measuring Intelligence.* Volta Review, Vol. 13, No. 1, April, 1911, p. 26.

[3] J. of Ed. Psych., October, 1910.

tests for feeble-mindedness were worked out for hearing children, they may readily be adapted for application to the deaf; or, at any rate, may serve to indicate the principles upon which a similar scale for such specialized cases might be based.'' The present paper will show that the scale as it stands cannot so readily be applied to the deaf.

The tests were given to a miscellaneous group of pupils at the Ohio State School for the Deaf.[4] In all, twenty-two pupils were tested, but the results obtained from a few of them were so meager as to be of little account.

We first made an attempt to apply the tests in written language only. For this purpose all the questions were typewritten on separate slips of paper, and these were presented to the child in order. The child then gave the answer in writing. For the memory tests the numbers were exposed one at a time, allowing sufficient time for the child to read them, and then he wrote what he remembered. A strict carrying out of this procedure was soon abandoned, since it was found that very often the child did not understand the written question, whereas he did understand the same question if he were asked by means of the manual alphabet and sign language. Fortunately, one of the writers, Mr. Paterson, was sufficiently well versed in these methods of communication to be able to reach the children. The ultimate method, then, of giving the tests was a mixed one. The manual alphabet and sign language, oral methods as far as possible with orally-taught pupils, and writing wherever this was feasible were all used at the discretion of the tester. Our main object was to see how many of the tests could be applied and to give the pupils as good a chance as possible. Such a mixed method of applying the tests would not, of course, be the ultimate ideal way. If these tests are to be used for diagnostic purposes, the method of giving them must be standardized and rigidly adhered to.

Numerous difficulties were encountered in giving the tests, and these may be well summarized under three headings—(1) Lack of comprehension, (2) Lack of environmental experience, (3) Difficulties due to the peculiar psychology of the deaf.

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[4]The writers wish to acknowledge the kindness and courtesy shown to them by Mr. Jones, the superintendent; Mr. Patterson, the principal of the school, and all of the teachers.

Lack of Comprehension. The first difficulty encountered here was unexpected. We found that many of the children, and particularly the younger ones, did not seem to understand what a question was. They simply did not understand that we were asking questions. They evidently thought that we were telling them something more or less interesting, and something that certainly did not require an answer. And so they would remain gazing at the examiner or the written question. This is very much like the attitude of a feeble-minded child, but in many cases we believe that the child was not feeble-minded, and in others we know that the child understood the subject-matter of the question, but did not understand that it was a question. Again, in some cases the child would merely repeat the question or part of the question, and this again in cases where we think feeble-mindedness was not the cause. The child seemed merely not to know that we were asking a question or that an answer was required. Some of the difficulty we encountered here may be due to the usual class-room attitude of the child. A large part of the instruction requires the child to repeat again and again what the teacher has said. The responses that he is called upon to make are very largely imitative, particularly in the lower grades.

The meagerness of a deaf child's vocabulary was another factor that raised difficulties in getting the child to comprehend the questions. The knowledge of how much can be demanded in this respect of the deaf child at each successive age would naturally go a long way to solve our problem. We know that comprehension of our language is one of the greatest difficulties that the deaf child has to overcome, but what we do not yet know is precisely how much language we can expect of the normal deaf child at the various stages of his mental growth. A great many children did not seem to comprehend such a question as "What is the difference between a butterfly and a fly?" And yet they knew that a butterfly was larger than a fly, and that these two insects were not the same.

Lack of Environmental Experience. Under this heading come a few of the tests that obviously depend upon the environment of the child. The normal child will generally have

opportunity to handle stamps, but to many children in an institution this opportunity may not come very often, and they may remain for a long period in total ignorance of the value of a red two-cent and a green one-cent stamp. And so also in regard to money, but this to a much lesser extent. This same difficulty is encountered with other than deaf children, *e. g.*, children in children's homes, Gipsy children, etc.

The Peculiar Psychology of the Deaf. By this is meant the peculiar manner in which many of them express their ideas. Binet[5] himself speaks of the "peculiar mentality of deaf-mutes," and of having asked a deaf adult this question, "You were alone?" To which he received this answer, "Yes, I am alone, and I have two deaf-mute comrades." Let us give a few examples from the replies to some of the questions in our tests.

Q. What would you do if you broke something that did not belong to you? A. If I broke something that did not belong to me, perhaps Mr. J. would be mad with me. Q. What would you do if you were going somewhere and you missed the train? A. Baltimore and Ohio. A. I would be sad if I missed the train and I would go again. A. Go home, get candy. Q. What would you do if you were on your way to school and suddenly found out that you were going to be late? A. I would have no time to drink water. Q. What would you do if you were struck by a playmate who did not do it on purpose? A. I did not hit it. Neighbor's Visitors (Age XII) elicited the response: My neighbors would be surprised at a doctor, a lawyer and a preacher.

Some of this is no doubt due to the difficulty that the deaf have in expressing themselves in idiomatic English, but we do not believe that all of it can be explained by that alone. They also find it difficult to understand idiomatic English, and there would seem to arise a confusion of thought due to this partial comprehension, and made more confusing by their difficulties in expression.

In addition to these three main points, we noticed that most of the children tested were constantly on the lookout for any

[5] BINET ET SIMON. *Peut-on enseigner la parole aux sourds-muets?* L'Annee Psychologique, p. 373, Vol. 15, 1909. English translation in American Annals of the Deaf, pp. 4-33, Vol. 55, No. 1, January, 1910.

suggestion that the examiner might unconsciously give in order to help in answering the questions. In this respect they resemble feeble-minded children, although we do not thereby imply that this openness to suggestion is by any means a proof of feeble-mindedness. It is rather a result of the position in which the deaf are placed with respect to their hearing fellows. They must be constantly on the lookout for clues in regard to what is being said round about them, and in regard to the manner in which they are expected to respond.

The Tests.

In Table I are given the results for the individual tests; in the first column, the number of the test in Goddard's Revised Scale; in the second column, the number of children tested; in the third, the number of right answers; in the fourth, the number of wrong answers, and in the fifth, the number of cases in which we believe inability to answer was based upon inability to comprehend the question.

It seems probable that all questions in age III can be answered after the child has been at least one year in school. In age IV most of the questions are answered correctly, and those not so answered probably show real ignorance. In age V all questions can be readily applied. The 50 per cent. failure in question 5 did not arise from a misunderstanding as to what was wanted. In age VI questions 1, 2 and 3 are difficult to apply. We feel that we succeeded in questions 1 and 3, but in regard to question 2, the language difficulty was too great, and so we have registered all the failures as being due to non-comprehension, although some of these are undoubtedly due to ignorance. In question 4 (show right hand, left ear) it is surprising that ten out of eleven fail. These ten either did not know which was right and left, or had left and right completely reversed. All of the tests in age VII can be given. Questions 1, 4 and 5 were answered with little difficulty. The failures in questions 2 and 3 did not seem to be due to inability to comprehend the question. In age VIII the first question is again one of language, and failure to comprehend is evident. The high percentage of failures in questions 4 and 5 are not due to this. They were evidently too hard for the pupils

TABLE I.

Test.	No. tested.	Right.	Wrong.	Not comprehended.
III:				
1	1	0	0	0
2	0	0	0	0
3	5	3	2	0
4	15	13	2	0
IV:				
1	8	4	4	0
2	8	6	2	0
3	10	9	1	0
4	7	6	1	0
V:				
1	8	6	2	0
2	11	10	1	0
3	6	4	2	0
4	12	9	3	0
5	8	4	4	0
VI:				
1	8	6	2	0
2	16	5	0	11
3	5	3	2	0
4	11	1	10	0
5	13	9	4	0
VII:				
1	19	15	4	0
2	18	10	8	0
3	17	9	8	0
4	18	12	6	0
5	20	19	1	0
VIII:				
1	15	5	2	8
2	18	11	7	0
3	17	15	2	0
4	18	7	11	0
5	17	7	10	0
IX:				
1	16	2	14	0
2	16	4	1	11
3	17	11	6	0
4	18	12	6	0
5	16	5	11	0
X:				
1	16	12	4	0
2	13	4	9	0
3	13	2	11	0
4	6	0	2	4
5	12	4	8	0
XI:				
1	3	0	2	1
2	9	0	9	0
3	14	7	7	0
4	6	1	5	0
5	9	0	9	0
XII:				
1	6	1	5	0
2	7	0	7	0
3	3	0	3	0
4	5	1	4	0
5	4	0	4	0
XV:				
1	2	0	2	0
2	1	0	1	0
4	2	0	2	0

tested. In age IX, question 2, the definitions present the same language difficulty. Question 1 is evidently beyond the arithmetical ability of the children tested. Question 5 seems to show a real defect in the sensitivity for lifted weights. In age X we have again the language difficulty in question 4. In age XI we see the same difficulty with question 1, and that is the reason why it was attempted with so few of the children. We felt it was perfectly hopeless to attempt it again with the others. Question 2 seems to be too difficult. Question 3 was given in written form, and Pyle's[6] norm for eleven-year-olds was used as a criterion. Little can be said concerning ages XII and XV. Questions 2 and 5 in XII bring up the language difficulty. The other questions seem possible of application.

The survey of the results has led us to believe that the following tests ought to be dropped from the scale if it is to be adapted for diagnostic purposes for deaf children: VI, 2; VIII, 1; IX, 2; X, 4; XI, 1; XII, 2, 5. Again it would seem that the deaf are not on an equality with the hearing as indicated by the high percentages of failures in many of the tests. The following tests appear to us to be too difficult for the deaf child for the age in which they are placed: V, 5; VI, 4; VII, 2, 3, 4; VIII, 2, 4, 5; IX, 1, 3, 4, 5; X, 2, 3, 5; XI, 2, 3, 4, 5, and all in XII. It would seem that the scale as a whole is too high for the deaf child.

We are led to the same conclusion from a study of Table II, in which the results for each individual child are given. The first column gives the number of the child; the second, the chronological age; the third, the mental age, and the fourth, the number of years retarded.

None of the children, with the exception of No. 11, tested up to their age, and No. 11 was a boy who possessed quite a considerable amount of hearing. He could hear without any difficulty when spoken to slowly and distinctly in a quiet room. The mental age was computed by giving fractional credit in accordance with the number of questions which were given, and which we believed the child comprehended. Counting

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[6]W. H. Pyle. *The Examination of School Children.* New York: Macmillan, 1913.

TABLE II.

Record No.	Chron. age.	Mental age.	No. of years retarded.
1	Insufficient data.		
2	16	10.0	6.0
3	12	8.1	3.9
4	14	9.1	4.9
5	12	9.0	3.0
6	10	8.7	1.3
7	16	6.4	9.6
8	9	6.1	2.9
9	8	6.03	2.0
10	11	9.5	1.5
11	9	9.0	0.0
12	9	8.33	0.7
13	9	5.81	3.2
14	14	9.4	4.6
15	9	7.8	1.2
16	16	7.1	8.9
17	20	7.65	12.4
18	12	9.74	2.3
19	Insufficient data.		
20	19	4.99	14.1
21	Insufficient data.		
22	Insufficient data.		
n = 18. Average	12.5	7.9	4.58

1.00 as full credit for all questions in one age answered correctly, then one out of five was credited .20, one out of four .25, one out of three .33, and one out of two .50. This method is, of course, open to criticism when only two or three questions in an age can be asked. It obviously gives a very high credit for a right answer under these circumstances. It seemed, however, to be the only method open to us if we wanted to arrive at an approximate mental age, however inaccurate this latter might be, and since we are not here primarily concerned with diagnosing feeble-mindedness, it allows us to arrive at the amount of retardation in each case.

Of the twenty-two records, eighteen were full enough to be of value. The average chronological age of these eighteen children is 12.5; the average mental age, computed as we have explained, is 7.9, and the average amount of retardation is 4.5 years. Obviously this does not mean that the normal deaf child is four and one-half years retarded as tested by the scale, but it does seem to suggest the question whether perhaps the normal deaf child is not on the whole more backward than the hearing child of the same age. To arrive at some answer to this question we may eliminate some of the obviously feeble-minded from the table. No. 17 is clearly defective. He is twenty years old, and has been in the institution for twelve years and only reached the fourth grade. Similarly with No. 20, a boy nineteen years old, who has been in the institution twelve years and only reached the third grade. We may also eliminate No. 11, who has too much hearing to be classed as a deaf child. No. 7, who shows nine years retardation, is a girl of sixteen years, who has been in the institution two years and arrived at the second grade. She does not appear to us to be feeble-minded, and we would not, therefore, eliminate this record. No. 16, however, who shows less retardation, *i. e.*, 8.9 years, seems decidedly feeble-minded, having a shiftless gait and bad muscular co-ordination. She has been in the school six years and has only reached the third grade. If, then, we eliminate these four cases—Nos. 11, 16, 17, 20—and then add up as usual, we find that the average amount of retardation for the fourteen cases that remain is 3.4 years. We venture to suggest that it is very possible that the normal

deaf child is during his school life about three years retarded as contrasted with the normal hearing child. For diagnostic purposes the scale should, therefore, be shifted three years forward. If we do this, we find that eight of the children would be considered normal, as they undoubtedly are. Three, Nos. 3, 4, 14, would be considered backward, and the rest probably feeble-minded.

In summing up we conclude that the Binet-Simon Scale as it now stands cannot be applied satisfactorily to deaf children. The whole scale must, in the first place, be shifted three years forward, *i. e.*, age III on the present scale would have to be called age VI on the deaf scale, and so on. Further, there are a few tests which it would be advisable to eliminate from the scale entirely. These have been listed above in the text. Tests to replace these, standardized on hearing and on deaf children, are required. The writers suggest that the best type of test, suited to fill these vacancies, would be performance tests. A considerable amount of data was gathered by the writers with four form boards—Knox's Imbecile Board, Knox's Casuist Board, Knox's Feature Profile Board[7] and the Vineland Adaptation Board.[8] It was felt, however, that most of these form boards have, up to the present time, been so inadequately standardized that no useful interpretation of our results with the deaf could be given. We do feel, however, that this type of test is the one that is needed to complete a Binet Scale for the deaf. That such would be useful there is no doubt, in view of the thousands of deaf children in this and in other countries. The writers have merely attempted to point out the inadequacies of the present scale. The construction of an adapted scale for the deaf has still to be accomplished.

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[7]For a description of these three form boards see KNOX, *A Scale Based on the Work at Ellis Island for Estimating Mental Defect.* J. of the Amer. Med. Assoc., March 7, 1914; also, KNOX, *Tests for Mental Defectives.* The J. of Heredity, March, 1914.

[8]H. H. GODDARD. *The Adaptation Board.* Psychological Bulletin, Vol. 9, 1912, p. 79, and H. H. GODDARD, *The Adaptation Board as a Measure of Intelligence.* The Training School Bulletin, Vol. 11, No. 10, Feb., 1915, p. 182.

RELIABILITY OF ESTIMATES OF GENERAL INTELLIGENCE, WITH APPLICATIONS TO APPOINTMENTS TO POSITIONS.

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One often hears an employer speak somewhat as follows: "I don't care so much about an applicant's special training, so long as he has a certain minimum of knowledge and training understood to be necessary to do the kind of work in question. What I want to know is, 'How good a man is he?' " What the employer assumes is that there is something which may be called general intelligence or general ability, which more or less assures potentiality for efficiency. What he wants to know is the applicant's relative status with regard to this ill-defined something we call general intelligence.

This attitude is characteristic not only of employers in the commercial and industrial fields, but in fields of employment generally. It is characteristic, *e. g.*, of the attitude of educators desiring to fill important positions in colleges and universities. In the latter instance, to be sure, records of objective tests of scholarship in the way of written examinations are available and indispensable, but these test acquisition primarily and ability only secondarily; in addition, the question "How good a man is he?" is practically sure to be asked, and if asked, more or less roughly answered. It is usually answered in the proverbial testimonial with which we are all familiar, but which few of us know how to evaluate, unless we know the man who wrote it. Doubtless, any facts which would tend to make such certificates less flowery and more interpretable by reference to known standards of measurement would be acceptable. In the present paper the author hopes to make some suggestions for working out a scheme to enable us to make our statements increasingly more definite in this particular.

In connection with a study of mental tests in relation to general intelligence, published by Teachers' College, Columbia University, in 1912, the writer had occasion to have twelve persons, all professors or former students of Teachers' College, ranked in order of merit for general intelligence. Each was rated by the other members of the group, or by persons who were well acquainted with the twelve. Thirteen rankings in all were made of these twelve persons, including four by professors in Teachers' College, seven by students closely associated with the twelve subjects, and two rankings by the writer, made a month apart. Four years before, these same persons had been given a series of mental tests with a view to determining the relation of these tests to general intelligence. Some data are thus available for determining (1) the agreement among professors as to the relative mental status of persons well known to them; (2) the agreement of the estimates of the professors with those of advanced students; (3) the agreement between the mental status of a person as determined by opinions of this sort, and his status as determined on the basis of mental tests arranged and administered in 1907.

TABLE I.

Ranks of the Subjects in 'General Intelligence' as Estimated by Opinions of Associates.

No. of subject.	By Prof. A.	By Prof. B.	By Prof. C.	By Prof. D.	By Student A_1.	By Student A_2.	By Student B.	By Student C.	By Student D.	By Student E.	By Student F.	By Student G.	By Student H.
1	5	5	5	6	6	6	5	3	..	9	6	9	9
2	1	2	3	7	3	2	2	4	2	6	2	7	5
3	7	7	8	8	8	8	11	12	9	..	5	10	6
4	4	3	..	3	4	5	4	7	8	5	7	8	10
5	..	6	6	9	10	9	8	5	5	7	8	4	8
6	3	4	4	4	5	3	6	6	4	3	3	3	3
7	9	10	10	10	11	11	..	10	..	11	9	..	11
8	8	9	9	12	7	7	9	9	7	4	..	6	4
9	..	11	11	11	12	12	10	11	10	10	10	11	..
10	6	8	7	2	9	10	7	8	6	8	11	5	7
11	2	..	2	5	2	4	3	2	3	2	4	2	2
12	..	1	1	1	1	1	1	1	1	1	1	1	1

Table I gives the ranks of the subjects as rated by the different judges. The blank spaces in eight instances are due to the fact that the judge himself formed one of the group of subjects, and consequently omitted his own name in the rankings. In the remaining three instances the name was omitted because the judge felt that he did not know the subject sufficiently well to be able to rate him.

We may assume that the truest judgment concerning the mental status of an individual is that expressed by the average of the opinions of the most competent judges obtainable. The combined or true rating for each individual, in the present instance, is indicated in Table II. The order of merit and

TABLE II.

True Ranks of Subjects, and Distances Between Them, in Terms of Deviation from Median.

No. of Subject.	Deviations from the Median Rank of All.
12	+6.5
11	+2.94
2	+2.64
6	+2.0
4	+1.36
1	+ .45
5	— .46
10	—1.1
8	—1.74
3	—2.27
7	—4.09
9	—5.91

the distance between each two persons was obtained from Table I by the methods made familiar through the work of Cattell, Thorndike and others.[1] Hence the accuracy of the estimate of each judge in ranking the different subjects may be expressed in terms of a Pearson coefficient of correlation between this "true" judgment and the judgment of each. In a similar way the accuracy of the estimates given by the mental tests may be stated. These Pearson coefficients of correlation are given in Table III.

[1]For details see the author's *Correlation of Mental Abilities*, pp. 72-74, published by Teachers College, New York, 1912.

TABLE III.

Pearson Coefficients of Correlation Showing the Relative Reliability of the Estimate of Each Judge, and That of the Mental Tests, Given Four Years Previously.

	Correlation with True Estimate.	
Estimate of 'general intelligence' of subjects by Prof. A.....	.97	Av.=.90
Estimate of 'general intelligence' of subjects by Prof. B.....	.94	
Estimate of 'general intelligence' of subjects by Prof. C.....	.94	
Estimate of 'general intelligence' of subjects by Prof. D.....	.73	
Estimate of 'general intelligence' of subjects by Student A1.....	.92	Av.=.83
Estimate of 'general intelligence' of subjects by Student A2.....	.92	
Estimate of 'general intelligence' of subjects by Student B.....	.89	
Estimate of 'general intelligence' of subjects by Student C.....	.87	
Estimate of 'general intelligence' of subjects by Student D.....	.84	
Estimate of 'general intelligence' of subjects by Student E.....	.82	
Estimate of 'general intelligence' of subjects by Student F.....	.81	
Estimate of 'general intelligence' of subjects by Student G.....	.74	
Estimate of 'general intelligence' of subjects by Student H.....	.65	
Estimate of 'general intelligence' of subjects by 3 combined tests.	.84	Av.=.83
Estimate of 'general intelligence' of subjects by 5 combined tests.	.82	

The following points are worthy of note:

(1) the most accurate ratings are those given by three of the professors, and these agree closely among themselves. The rankings of the remaining member of the faculty—Professor D—are next to the most inaccurate of all. The relatively inaccurate rankings of Professor D are doubtless largely due to the fact that the subjects were not as well known to him as to the other professors. However, it is important that so marked a divergence as this from the judgment of others should be known and taken into account in recommending the persons here under consideration for positions.

(2) As to the rankings by students, the general fact is that they are appreciably less accurate than those given by the professors. There is considerable variation in their accuracy, ranging from a coefficient of .92 to one of .65, with an average of .83. Again it is apparent to the writer that one important factor making for inaccuracy in ratings is the fact that not all of the persons rated are equally well known to the judge.

(3) The accuracy of the mental tests used as a means of

measuring the relative intelligence of the subjects is practically the same as that of the judgment of the average of the student-judges, .83. Of the ratings by persons, 61 per cent. were more accurate than those by the tests. The average correlation for all judgments by persons was .85, as compared with .83 for the mental tests.

In this connection it must be remembered that the tests were arranged and administered in 1907. Had they been selected and administered as late as 1912, the results given by them would have been considerably more accurate. Also, if the judgments by persons had been given in 1907, when the tests were given, instead of in 1911, they probably would have been considerably different, as some of the subjects had meanwhile attained a degree of prominence that must have modified the judgments.

If it could be shown that a series of tests could be given now that would give us as accurate an estimate of the general mental ability of graduate students as the average judgment of the professors, it would be a fact of a great deal of importance. In view of work done in the last three years, this seems not improbable, provided sufficient care, time and psychological insight are used by the experimenter. Mechanical and superficial administration of mental tests has already done sufficient damage in this important domain of psychology, even in cases where the writers have believed themselves to be putting down a perfectly reliable P.E., as the writer hopes soon to emphasize from available data.

Application to Appointment to Positions.

Selecting a man for a college position at $2000 a year to teach history of education and psychology presents little difficulty up to a certain point. The number of competent persons available at any given time and place is not likely to be large. In the selection two questions arise: (1) Of the persons available in any one university, which candidate is the best? (2) Just how good a man is he?

The first question, usually, is easily answered. However, reference to the ratings of subject number 10 by the four professors, as shown in Table I, would show that a prospective employer might be considerably confused as to the mental

status of this subject if he first consulted Professor D or his recommendation and then Professors A, B and C or their recommendations. Practically no doubt what is brought to bear upon the prospective employer is a somewhat roughly combined judgment of a number of professors and instructors as presented through an appointment secretary. In that case it remains merely to have the data in a form which is definite, accurate and easily interpretable.

The second question—just *how good* a man is candidate A—is not so easily answered. This is where the interpretation of the testimonial comes in. The following suggestions are thrown out in the hope of outlining and stimulating the working out of more scientific methods of meeting this and similar problems:

The obvious data to be used in an attempt to rate graduating students on an objective scale would be a table something like Table I, obtained by having the students confidentially rated in order of merit for general mental ability by the professors and instructors well acquainted with them. Table II is, so far as it goes, such a scale, constructed on approved principles from the data of Table I. What is needed is to extend the application of the principle so as to make it include a larger number of students whom it may be desirable to rate for any one year, and secondly to make the scale cumulative. By this I mean to have the outgoing class of 1908 in one column, as in Table II, the class of 1909 in a second column beside it, and so distributed that the status of each person in the 1909 column is accurately indicated by a point on the scale in relation to the position of the members of the 1908 class. Each year adds a new column to this cumulative scale, so that at the end of ten years the appointment secretary is able to state definitely to an official seeking the best available man for a position, that Mr. A is rated on the official scale as $+2.1$. Looking across the line horizontally one sees the names of those who in the last ten years were rated about equally with him. Some of these will often be known by the inquiring official personally or through their works. In this case we have a statement that is definite and in terms of the known.

What difficulties there are in the practical working out of such a scheme appear in properly treating the data given in

the original table of ranks and in getting this data from the professors and instructors. In most cases in our large universities not all of the students whom it is desirable to rate are known by a sufficiently large number of professors. For instance, toward the close of the academic year the appointment secretary sends out to each instructor and professor a list of all the students to be rated on the scale, with these instructions: "Select from the enclosed list those students concerning whose abilities you are well acquainted. Arrange them in order of merit with respect to general intelligence and mental ability, putting down as No. 1 the person most able, No. 2 the person next most able, etc." What the appointment secretary gets in reply to his request depends upon conditions at the university and in the department where the request is made. Some students may be well known to only four or five professors, and accordingly be rated by only so many. Probably no professor would include more than twenty on his list, as most judges find that they cannot with satisfaction to themselves rate a larger number than this in order of merit where range of differences in ability is no greater than among advanced graduate students of a university. Thus there would be adequate data for rating some in relation to the other students present for the year and inadequate data for accurately rating others.

Let us look at the situation and see what is to be done with the data. The methods would, of course, vary more or less with the conditions in any particular institution and with the needs. The writer has in mind needs and conditions in a certain graduate department of a large university. This department is probably fairly typical in the respects now under consideration. Here it is of prime importance to rate in this way only those who are highest in attainments, capable of filling positions of leadership and progressive scholarship, and ready for appointment at the close of the year. The most of them are Ph.D. candidates who have been in residence from one to three years.

On the whole, the most advanced and capable of them are well known to from five to ten members of the faculty by the time they are ready for graduation and appointment. Con-

sequently they are rated by a sufficient number of professors to enable the appointment secretary to assign them a fairly accurate place on the scale for that year.

The second problem consists in making the scale cumulative in the sense explained above. In order to do this it would be necessary for the appointment secretary to send out to each instructor or professor a second list of names to be similarly rated in order of merit. The second list would contain the names of the first list, and in addition the names of seven or nine of the well-known names on the scale of the previous year, preferably one name from about the median ability, one from each of the extremes of ability, and the others from intermediate points along the scale. This addition to the list of names would probably make it necessary for each professor doing the rating to drop some of the names previously rated. Nevertheless, with the two sets of ratings the appointment secretary would have the necessary data for constructing a usable and useful cumulative scale. The position of each person in the 1909 column of the cumulative scale is determined in relation to his position with reference to those in the list for 1908 rated with him. The principle involved is essentially that used in constructing Table II. To be sure, in this form the method might not in all respects suit the requirements of the critical mathematical theorist, but for the present we are more concerned with practical improvements in methods now used than with pleasing the mathematical theorist.

This represents at least a fair organization of data that is under present conditions more or less used, but in poorly-organized form.

Illustration of the Advantages of Such A Scale.

Last summer the writer was talking with a university administrator who has been unusually successful in placing a large number of teachers in the Middle West to the satisfaction of all parties concerned. He attributed his success in this respect to the fact that he had gained the confidence of many school officials needing to secure teachers mainly through his ability to appreciate their requirements and through his absolute candor in discussing with officials the merits and weaknesses of the different teachers available for any positions

they had to fill. For instance, in response to a request for a certain grade of teacher: "We have at present no teacher available who quite measures up to your requirements, though Miss A comes near it. She is about the same type of teacher as Miss X, whom we sent to your friend, Superintendent B, about a year ago, though as yet somewhat less scholarly," etc. In reply comes the telegram: "Send her along." Later comes the request: "Send us a teacher for such and such a grade of work if you have one that you consider satisfactory."

In a similar way the cumulative scale would enable the institution possessing it to give increasingly definite information which should carry confidence with it. Some of the flowery language concerning the candidate which is ordinarily thrown in along with the certification as to his scholarship and training for the particular position in question could be dispensed with to make room for such statements as the following: "Mr. A has been rated in general mental ability by our faculty on a scale containing the names of our most advanced students arranged in order of merit. The scale contains also the names of former graduates similarly arranged. His position on the scale is represented by the grade + 2.14, *i. e.*, a deviation of 2.14 above the median for students of Ph.D. calibre. You will notice that this point on the scale is practically the same as that indicating the status of Dr. C., a graduate of 1910, now professor of psychology in the University of K. In the past ten years we have had only two students majoring in the department of History of Education who were higher than this, *viz.*, Dr. E., a graduate of 1906, now professor of education in the University of O., and Dr. G., etc. It is very little below the estimated status of Professor H, of whom you probably know. You would evidently be fortunate to secure the services of Mr. A. As to initial salary, those graduates of last year who most nearly parallel him on the official scale received $2200 and $2500, respectively."

Such statements are similar in character to statements now made in private conversation, but are more definite and accurate. It is not claimed that a candidate's position on this scale is a guarantee of just how difficult and responsible a position he can fill, but it is claimed that it would be a means of representing more definitely and accurately than we now

state it what is to be expected of any particular man. Confidence in the recommendations made would be correspondingly increased.

While the system here outlined would enable an appointment secretary to rate only the best-known persons coming under his jurisdiction, the head of any single department with few students in it each year could easily keep his own private cumulative scale, containing only the names of students majoring in his department.

It would also make it easily possible to rate with a far greater degree of satisfaction than is possible at present, the person who is well known to only one or two professors. A person is not necessarily inaccurately rated if the rating is done by only one or two judges, *provided the judges are good judges*. We do not say that a case in court is unfairly tried just because the responsibility of determining the verdict rests with only one judge. We must be careful to keep in mind all of the variables that function in the matter under consideration. The quality of each judge is a factor which is often of equal or greater importance than the number of judges. Having the cumulative scale as a standard of measurement, provided (1) that a professor knows well a considerable number of the persons whose positions are represented on the cumulative scale, and (2) that he knows well the student to be rated, it is not expecting too much of human nature that his judgment alone should place the student's relative mental status on the scale with a satisfactory degree of accuracy—a far greater degree of accuracy and definiteness than would be possible without the use of the scale. This is the extreme case. It should rarely happen that a student in residence for one year would not be well known to at least three teachers.

Further applications will easily be suggested. Besides its immediate practical value, such a scale would provide much needed data for enabling us to correlate success in after life with predictions of success, made upon entering one's professional career. This, in turn, would be valuable material in aiding us in the analysis of those factors that make for practical success.

THE ELIMINATION OF FRESHMEN FROM THE UNIVERSITY OF TEXAS.

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(*Contributions from the University of Texas Educational Laboratory, No.* 1.)

The study of elimination from the lower schools has attracted a great deal of attention during the past few years, but elimination from college has received very little study, and the conclusions drawn have too often been mere generalities inaccurately based upon class populations. Such a basis does not truly represent individual elimination, since it does not take into account the elimination that is offset by those entering with advanced standing. Equally inaccurate is the "student history" plan which fails to take into account the modifying factors of retardation and acceleration.

In the present study both of these bases have been used with the modifying factors mentioned. Each name in the freshman lists of the University of Texas catalogues for 1901 to 1908 was traced through the sophomore lists of the year following, the junior of the next year and the senior of the next, or until the name failed to appear. If it failed to appear in the sophomore list, search was made in the next catalogue to see if it appeared as a second year freshman. If found there, it was dropped from the other year and used as other freshmen of this year, but listed as retarded. If it did not appear there, the junior class list of this catalogue was examined to see if the student had skipped the sophomore class. This process was repeated for three successive years, unless the name appeared

sooner. The normal, the retarded and the accelerated pupils were kept in separate lists, and no name was recorded twice in the same class.

The record of this method is shown in Table I. The first column under each university class name represents the number of students accelerated for that year skipping the class before; the second column gives the number progressing year by year until they withdrew permanently, including those who withdrew for less than four years but advanced one class each year after returning; the third column represents the number retarded, their names appearing a second time in the same class.

TABLE I.

Year.	Freshmen.			Sophomore.			Junior.			Senior.		
	Ac.	Nor.	Ret.	Ac.	Nor.	Ret.	Ac.	Nor.	Ret.	Ac.	Nor.	Ret.
1901.....	..	246	..	..	..	..	..	..	..	..	..	..
1902.....	..	148	12	..	106	..	..	..	..	..	..	..
1903.....	..	150	26	..	66	2	3	56	..	..	..	..
1904.....	..	266	19	..	92	1	..	40	..	9	40	..
1905.....	..	333	29	..	123	2	2	40	..	6	31	..
1906.....	..	339	39	..	154	11	4	82	5	7	20	..
1907.....	..	373	48	..	137	6	5	78	..	9	32	..
1908.....	..	305	46	..	114	14	2	77	..	7	43	..
1909.....	..	..	..	..	86	14	2	55	..	8	56	..
1910.....	..	..	..	..	..	..	11	30	..	5	28	..
1911.....	..	..	..	..	..	..	..	..	..	9	32	..
Total.....	..	2160	219	..	876	50	29	458	5	60	282	..
Class total.....		2379			975			552			342	
Per cent. of entrants		100			40			23			14	

To determine the elimination, retarded pupils are included, since they have been counted but once; and accelerated pupils, having skipped a year officially, but not in actual work done, are added both to the class in which they stand and to the one preceding. This gives the percentages at the bottom of the table, and also those upon which Figure I is based. The percentages for Figure I, however, are worked out for each separate year. The lines, showing this graphically, cross to the following year under each successive class. The heavy line represents the percentages of the totals given in the table above.

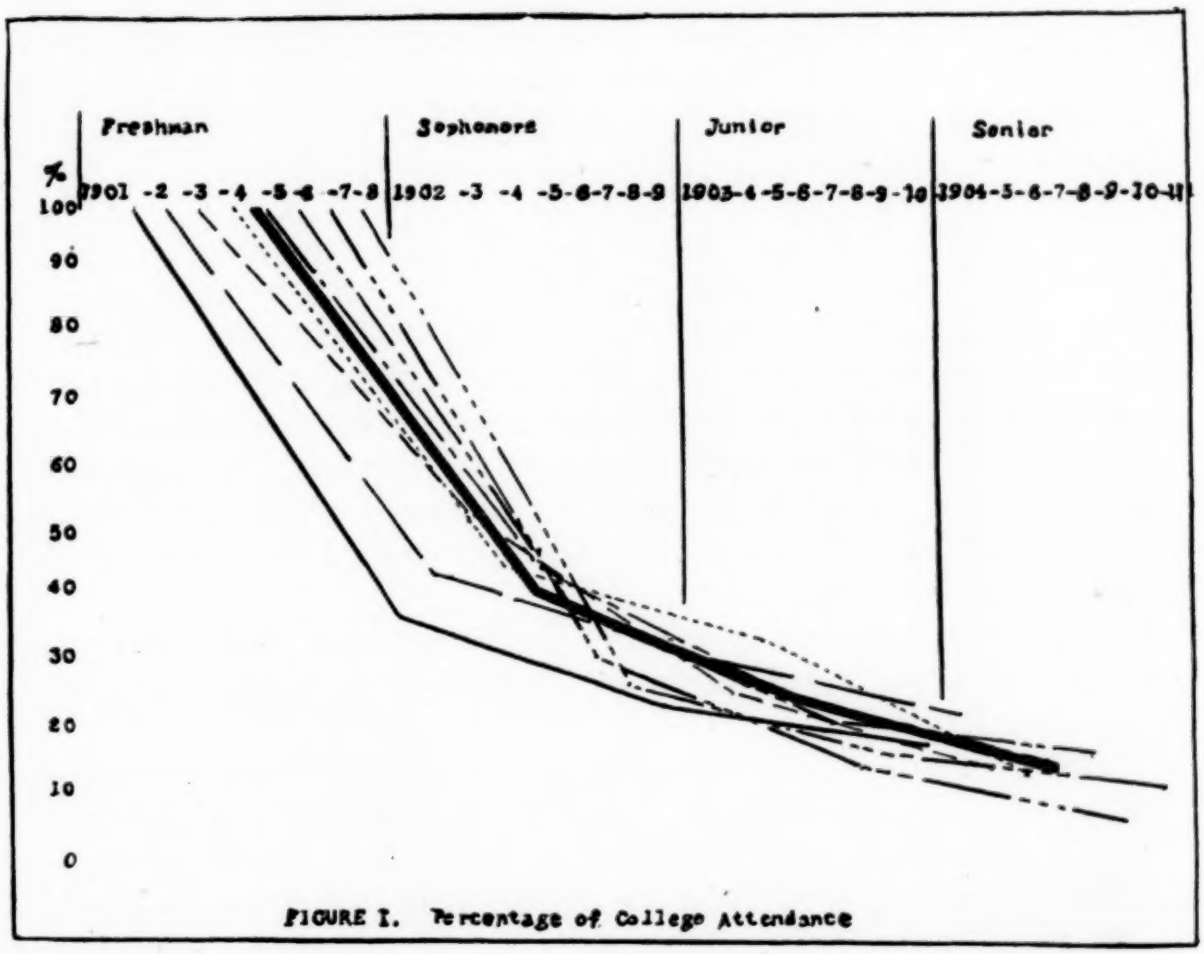


FIGURE I. Percentage of College Attendance

Table II gives a comparison of the results obtained in this study with the data secured by Strayer[1] from twenty-seven colleges having over five hundred students each. His figures are based on class populations, those in this study on student histories in one column, and on class population in the other.

TABLE II.

	Enrollment in Twenty-seven Colleges (S.)			Enrollment in Univ. of Texas.		
	Range. Per cent.	Med. Per cent.	Mid. 50%. Per cent.	Med. Per cent.	Stud. Hist. Per cent.	Class Pop. Per cent.
Freshman	100	100	100	100	100	100
Sophomore	40-100	76	65-92	79	40	49
Junior	25-100	57	42-71	57	23	33
Senior	12- 90	46	30-67	49	14	31

It will be seen that the University of Texas computation on the basis of student histories gives appreciably lower percentages than by class population, and it may be assumed that the same would be true of Strayer's figures. As explained above, class populations include all pupils who enter with advanced standing, while student histories include only those pupils who enter as freshmen.

The extremely low percentage of freshmen who returned to the university led us to inquire into the causes of such conditions.

The result of a questionnaire presented to a freshman class of thirty-nine pupils showed that they studied on an average four and three-quarter hours per day per pupil, outside of class, while seniors in the high school; and studied six hours as freshmen in the university. They received an average grade during the last year at high school of 85 per cent., while they got only 70 per cent. at the university. Based on hours of work done, the university ranked them only two-thirds as high as the high school did. Data from so small a group were not considered conclusive, but they pointed to the fact that there is a wide difference between the standards of marking in the two systems, a difference which tends to dishearten students when they enter the university.

[1] GEORGE DRAYTON STRAYER. *Age and Grade Census of Schools and Colleges.* Bureau of Education, Bulletin, 1911, No. 5, p. 137.

Subsequently, through the courtesy of the school of English, the following questionnaire, seeking the opinions of the students on the reasons for elimination, was put into the hands of six hundred freshmen:

1. Name .....
2. High school from which you graduated.....
3. Number of courses carried in high school.....; in the university.....
4. Average number of hours studied per day outside of class: (a) the last year in high school.....; (b) this year in the university.....
5. Number in order of importance, with "1," "2" and "3," the causes below that are likely to have the greatest influence toward inducing you to leave school before the end of the second year:
   (a) Ill-health; (b) lack of money; (c) discouragement because of low grades; (d) tired of school; (e) not getting what was expected.

The students were given two days in which to reply, so that the answers would be carefully considered. Into the three hundred and eight replies, forgetfulness, carelessness and misunderstanding entered, but I believe that the averages show rather reliable tendencies and conditions.

Table III gives the courses carried and the hours studied in both the university and the high school:

TABLE III.

Courses carried	1	2	3	4	5	6	7	8	9	10
By university students....	..	1	5	84	190	3	..	..	..	..
By high-school students...	..	1	4	52	158	55	26	7	1	..
Hours studied	1	2	3	4	5	6	7	8	9	16
By university students....	1	14	34	58	64	56	28	18	5	7
By high-school students...	23	66	58	72	39	25	5	10	..	..

The average number of courses carried per student in the university was 4.63, in the high school, 5.09; of hours studied per day outside of class, in the university, 5.11, in the high school, 3.61.

Table IV gives the opinions of the students on causes that were most likely to lead to their elimination from the university:

TABLE IV.

Importance.	Disappointed.	Low grades.	Money.	Health.	Tired.
1st	37	63	113	91	18
2d	52	64	65	79	20
3d	63	68	33	41	39

While the figures given as second and third rank of importance do not seem valuable, those in the first rank do seem significant. "Lack of money" is by far the most prominent, followed in order by "Ill-health," "Disappointed" and "Tired of school."

Figure II shows the scholarship standing as taken from the Registrar's office, of the different groups of students according to their indication of the first cause of elimination. The top lines represent average grades in the high school, those immediately below, average grades in the university. The dotted lines represent the difference in grades received.

It will be noted that the high school grades are about 16 per cent. higher than those of the university, and this does not take into account the fact that students spend more time at study in the university than in the high school. This condition corresponds very closely to that found in the test of the thirty-nine students mentioned before.

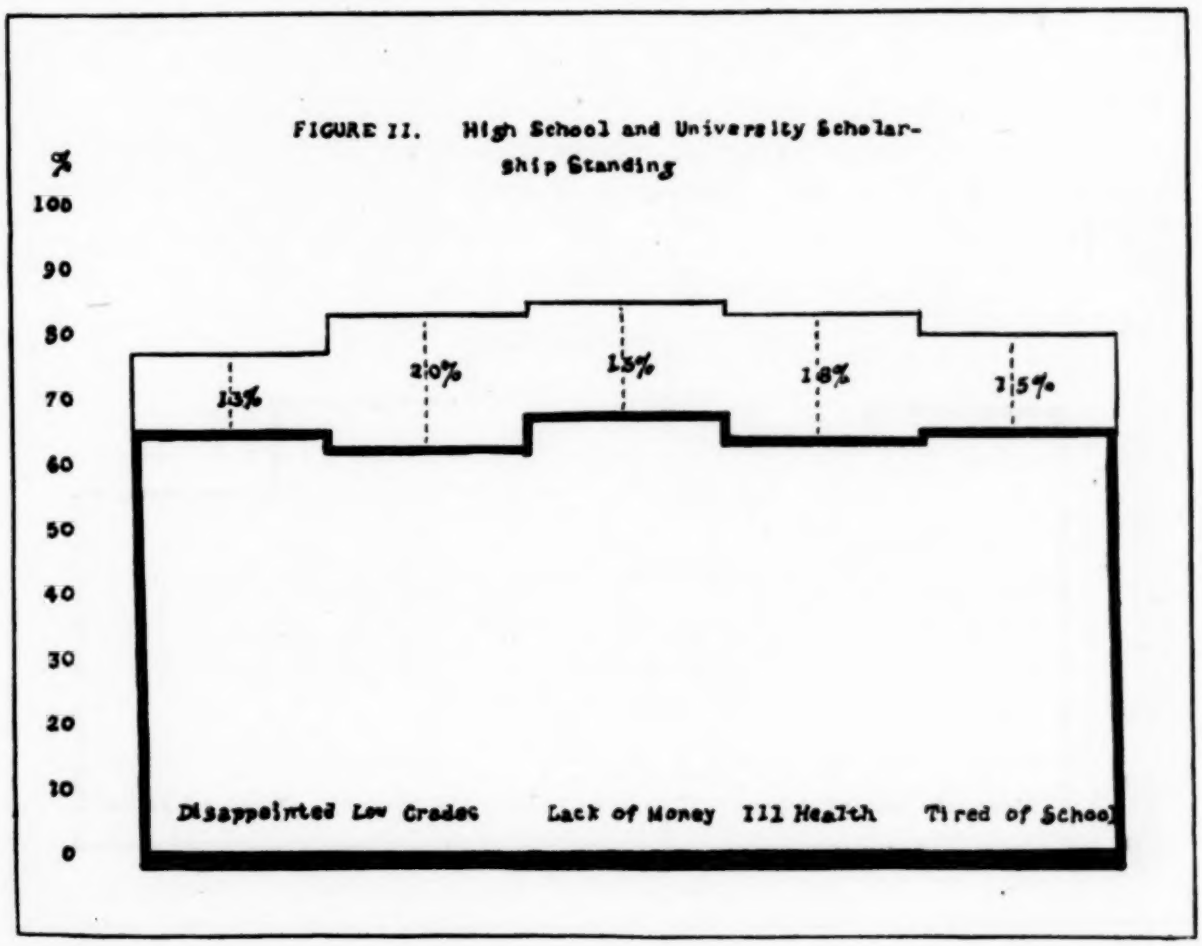
Figure III represents the minutes studied in the university per subject per day outside of class by the average freshman answering the questionnaire. The grouping is the same as that in Figure II.

We see that students with the least means study most, and those "tired of school" study least; those who make the lowest grades are next to the bottom in the amount of study. This is what one would expect.

A similar questionnaire was sent by means of return postal cards to eight hundred and fifty freshmen who had registered during the sessions of 1910-11 and 1911-12, but who had failed to return. Only one hundred and eight replied. More than half of those replying had no high school records in the Registrar's office, having entered on individual approval. Of those replying, nine were attending school elsewhere and fifteen meant to return to the university soon. The results, therefore, are not as complete as could be desired, but serve to corrobate the tentative conclusions drawn from the previous inquiry.

In tabulating the answers the second and the third causes of elimination were so few and so unsatisfactory that they were disregarded altogether. The first causes were as follows:

FIGURE II. High School and University Scholarship Standing



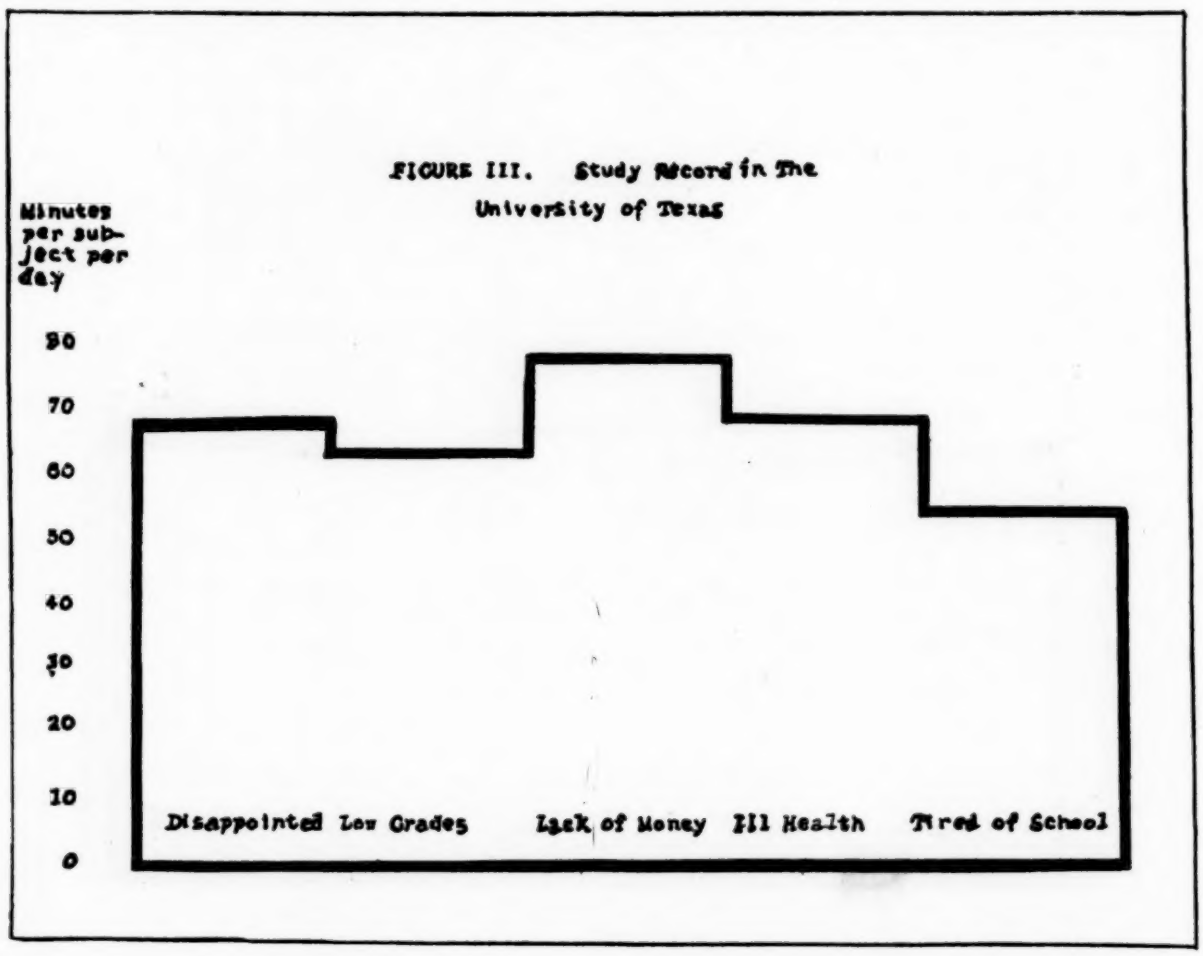


FIGURE III. Study Record in The University of Texas

"Ill-health," 20; "Lack of money," 54; "Discouraged because of low grades," 5; "Tired of school," 9; "Not getting what was expected," 5; other reasons, 15. Here as before "Lack of money" far out-numbers the rest, with "Ill-health" as second. However, those who were "Tired of school" occupied a higher place.

Tables V to VII show the results of this study:

TABLE V.

Hours Studied.

Hours studied	1	2	3	4	5	6	7	8	9	10
By university students	..	2	15	13	16	10	1	8	1	1
By high-school students	3	25	16	13	4	2	4	4	..	..

TABLE VI.

Average Hours Studied by Each Group.

Group.	Students.	Hours in the university.	Hours in high school.
Health	20	2⅘	4⅔
Money	54	5	3¼
Discouraged	5	6	4
Tired	9	4	3
Disappointed	5	4	2

TABLE VII.

Scholarship Standing.

Group.	Students.	Grades in university.	Grades in high school.
Health	4	D—	B—
Money	16	C+	B
Discouraged	2	D—	B
Tired	5	D+	..
Disappointed	2	B—	A—
Others	14	C	B+

Reducing to arbitrary percentages, as was done in the former studies, by giving A the value of 90 per cent.; B, 80 per cent.; C, 70 per cent.; D, 60 per cent., and E, 50 per cent., we find that the difference between the standards of grading in the two systems is again about 16 per cent. Of the students who did not answer the card, the grades of one hundred and forty-one, found in the Registrar's office, showed a difference of 13 per cent. From these figures it was also discovered that the

students having the lowest grades in the university failed to answer the cards.

Conclusions and Recommendations.

1. About 60 per cent. of the freshmen withdraw permanently each year from the university.

2. Lack of means causes about 34 per cent. of this elimination. Is it not the duty of the State to furnish such allowances by means of scholarships as would meet the needs of able and worthy students?

3. Ill-health causes 28 per cent. of all elmination. Most of this may be charged to the student himself, but the State should furnish adequate and sanitary dormitories and other buildings urgently needed.

4. A small percentage of elimination is caused by inability and lack of effort on the part of the student.

5. About one-third of all elimination is caused by the fact that the scholarship rating of freshmen in the university is only two-thirds of the rating of the same students in the last year of high school, when based upon the actual amount of time spent in study. The serious break in a student's standing when he enters the university tends to discourage him and to drive him out of school.

The university should raise its scholarship rating of freshmen students about 10 per cent., or one letter, according to the system of marking in use, and the high schools should lower that of their senior classes about the same amount. This would close the unnatural and harmful breach between them, and would reduce this large percentage of elimination.

6. Students lacking means study longer and make better grades than those of any other group. Those who are tired of school study least of all and make relatively low grades.

PROBLEMS IN THE EXPERIMENTAL PEDAGOGY OF CHEMISTRY.

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The justification for including a subject in the curriculum of the secondary schools is either that through the study of it the pupil shall acquire useful information, or that it is well adapted for developing him mentally. The multiplication table is learned because it is useful in after life; it is a time-saver. Geometry, on the contrary, is taught not because it is essential to the majority of high school graduates, but rather because it is said to afford an excellent means of mental training. Luckily, the study of most subjects not only imparts useful information, but at the same time tends in some degree at least to increase the mental capacity of the pupil. That chemistry belongs to this latter class will scarcely be doubted by anyone at all familiar with the subject. In addition to a large number of very desirable facts, it offers excellent opportunities for training in manipulation, in specifically directed and intensive observation, in the correlation of ideas, and in logical reasoning. It should also stimulate the visualizing and creative imagination, foster the spirit of investigation and verification, and contribute toward the development of the so-called scientific spirit which, in the last analysis, is none other than the desire for truth.

From a consideration of an overcrowded curriculum the educator in a secondary school is called upon to decide whether or not chemistry offers equal or greater advantages than do other subjects for development along the lines just indicated. The field opened by the study of chemistry is very comprehensive, and it may be argued by some that this fact militates against material progress in any one direction.

Closely associated with the question of the desirability of

teaching chemistry is that of the amount of time necessary to give tangible results in the subject, and the manner in which this time shall be distributed. Is it, for instance, worth while to spend one year—approximately two hundred hours—on chemistry and then stop? Or would it perhaps be more efficacious to concentrate less and distribute the time over two or more years? Nor is that quite all. There must be due consideration of the manner and time of introducing this study. These are questions that can be answered partially at least by experimental investigation, and the possible lines of attacking the problems will be suggested under specific headings in the course of this discussion.

In order to determine the progress that has been made as the result of the pursuit of any given study, standards of measurement and methods of testing the results must be devised. Where the effect of the teaching is definite and tangible, the standards and tests are correspondingly simple and direct in their bearing. Spelling and drawing are taught in order that the pupil may be able to spell or draw, arithmetic to enable him to determine with facility and accuracy the amount of the grocer's bill or the contents of a pay envelope. The complete effect, however, of the teaching of these subjects may be much wider than this, and, as a result, more difficult to measure by any experimental method.

The few elementary facts of chemistry that are acquired and retained by the average high school pupil are of little value to him unless he can follow up the study after he has left the secondary school either in an institution of higher learning or in a trade in which he will use chemical processes. This will be the case with the smaller proportion of the pupils, as the majority of them will go into occupations where no such practical use of chemistry is made. The time spent by them in this study in the high school would be wasted, therefore, unless they have derived mental training along some one or all of the lines indicated in the opening paragraph. Although such training is difficult to measure, because of its intangibility, it is nevertheless in this direction that we must turn our attention if we are to obtain experimental evidence of the comparative value of the work.

It is not within the scope of the present article to discuss at length the nature of the tests best suited for the purposes of this sort of investigation. That is the province of experimental education; and it will doubtless be found that the methods at present employed in other branches are applicable in this new field of research. In general, it may be said that any tests applied must be made with the pupils before, during the progress of, and at the conclusion of the course. The same tests must be made with pupils taking courses other than chemistry, and the advancement of the various groups compared. Finally, these tests, to be of any real value to the educator, must be made on large numbers of pupils in many different schools in order to eliminate as far as possible the personal factors involved in the teacher and the type of pupil.

Let us next turn to a detailed analysis of the topics mentioned in the first paragraph of this article, and to the consideration of their fundamental and dynamic relations to the intellectual growth of the pupil.

Manipulation.

The problem of the education of the young by the use of the hands is a vital one, whether in the home, the school or the factory. It is pertinent in experimental chemistry because of the many opportunities for making, setting up and handling apparatus varying greatly in nature and use. Pupils on entering the course differ in a marked degree in inborn manipulative ability. To what extent this ability can be cultivated and improved by experimental work of such a special character is an interesting consideration for the educator. Furthermore, granting that improvement can be made, what should be the nature of the apparatus in order to increase the pupil's dexterity with the hands to the greatest possible degree in the time at the disposal of the teacher? The apparatus may be varied a great deal and less time devoted to any one mechanical action, or the operations may be repeated a great number of times until the pupil becomes proficient, as is necessary in successful glass-blowing. The handling of delicate apparatus, such as the chemical balance, should improve the

pupil's manipulative skill, but the results may not repay the outlay of time and energy necessary to obtain them.

Another point that demands attention in the consideration of the training of the pupil through the hands is the value of quantitative, or semi-quantitative, experiments as opposed to the purely qualitative. The latter tend to make the pupil careless and inaccurate in his habits, while the former are of necessity time-consuming. Last, but not least, the problem should be investigated as to whether the pupil learns to manipulate best by imitation (demonstrations by the teacher) or by being required to experiment with the apparatus until he discovers the most advantageous method or methods.

Observation.

Observation is, of course, of two kinds: that which is casual and that which is directed with some specific object in view. It is doubtful whether the study of chemistry will increase the power of the pupil to observe casually; but it would be interesting to have data on this point. The real problem, however, is whether the training he receives through the agency of chemical experiments enables him to observe more efficiently when called upon to do so in the ordinary occurrences of life, for it is with this end in view that we should endeavor to develop the pupil. The value of lecture experiments for the cultivation of observation is a question worthy of consideration in this connection. As a result of lectures copiously illustrated by experiments or of demonstrations given by the teacher, does the pupil's capacity for comprehensive observation improve materially? Now, it is true that a great deal of his knowledge in life is derived from observing the performances of others, hence it follows that the cultivation of his powers in this direction is highly desirable.

With regard to the experiments that the pupil is expected to perform himself, the question may be raised whether he should be given careful directions for the operations involved and left to observe all he can, or be warned to look for important points and for special phenomena. There is undoubtedly much to be said on both sides of the question, but at present we have little upon which to form definite opinions. If

the pupil is left to his own devices, he is liable to see the most spectacular phenomena only, and miss oftentimes the more vital. Take this instance. If a pupil is asked to record what he sees when copper filings and sulphur are heated in a test tube, he will probably note with the utmost care the exact manner in which the fumes of sulphur come off, missing entirely the fact that the reaction when once started will proceed by itself, causing the mass to become red hot on account of the heat generated. If this experiment was intended to show that some mixtures may burn without the presence of air, most pupils will fail to make the proper observation. This brings up another issue, *viz.*, precisely how can the pupil be trained to distinguish between the important and the minor or non-essential aspects? More than that, what is the educative value of the repetition of experiments when the pupil has omitted some important observations?

Correlation of Ideas.

From the fact that the pupil's knowledge of material things consists of relationships, similarities and differences, it follows that the recognition of these relationships by the pupil is of vital importance in acquiring a knowledge of chemistry. It is here, however, that the beginner is confronted by one of his greatest difficulties. He is met by a bewildering array of new facts and complicated phenomena. He is obliged to employ new processes of thought, and to express himself with exactitude (perhaps for the first time in his life) by means of a vocabulary where even the terms and expressions are unfamiliar to him. It is not astonishing, therefore, that the pupil should have difficulty in realizing the connection between ideas in a subject that presents so many new experiences to him.

It would be a fruitful line of research to investigate what can be accomplished by way of inducing the pupil to correlate fact with fact, fact with theory or theory with theory. It is still more important perhaps that he should connect what he learns in chemistry with the phenomena encountered in everyday life. A question for careful consideration here is the effect of closely-connected experiments on the pupil as a test

of his tendency to correlate. In other words, it behooves the teacher to ascertain whether the experiments the pupil is called upon to do should be chosen to illustrate the specific point at issue regardless of their connection with one another, or whether they should be correlated as much as possible. For example, combination of synthesis can be illustrated very well by heating magnesium or lead in the air, and metathesis by mixing a colorless solution of lead acetate with a reddish brown solution of copper chromate. In the latter experiment the double decomposition is manifested by the resulting blue liquid and the yellow solid. The same two changes may be equally well illustrated by heating copper and sulphur together, showing combination, and treating the copper sulphide thus formed with nitric acid to give an example of metathesis. Until we have evidence to the contrary, it would seem that the pupil's chances of realizing the relation between synthesis and metathesis would be greatly enhanced by having the experiments illustrating the two phenomena closely connected, yet this is a device seldom made use of in our laboratory manuals of chemistry.

Before concluding the discussion concerning the correlation of ideas, it might be pointed out how this close association between experiments may be extended to a very considerable degree. For instance:

1. Solid copper nitrate, which the pupil can make by evaporating down the solution obtained from the experiment with copper sulphide and nitric acid, may be left standing exposed to the air whereby the solid takes on moisture, thus illustrating deliquescence.

2. A few lumps of the solid placed at the bottom of a tall breaker or flask filled with water shows nicely how a dissolved substance diffuses throughout the entire liquid.

3. Copper oxide may be made by heating the nitrate, and it may also be made by heating copper in the air.

4. Copper hydroxide is easily obtained by adding a base, such as sodium hydroxide, to the nitrate.

5. Copper, copper oxide and copper hydroxide treated with nitric acid are typical examples for the formation of a salt.

6. Nitric acid, because of its volatility, can be driven from

its salts by heating them with sulphuric acid, as instanced by the formation of copper sulphate from the nitrate.

7. The water of crystallization of blue vitrol may be expelled and added again at will. In this manner the pupil acquires the idea of hydrates.

Logical Reasoning.

Generalizations, involving as they do one or more judgments or conclusions, are not only the necessary result of the study of any subject, but are made by every man in every walk of life; it matters not whether he sells typewriters or occupies the speaker's chair. These judgments will be justifiable only in case the premises upon which they are based are correct. The trouble with the untrained and the prejudiced man is that he often does not examine these premises carefully enough to be able to determine their validity. Now, this examination of the evidence is not so simple as it may seem at first sight. It frequently necessitates a form of analysis that is peculiar to the subject in hand, and is, therefore, largely dependent upon training. One common source of error is not being in possession of all the facts; another is the failure on the part of the reasoner to take into consideration all the facts he already has in his possession.

It would be no more reasonable to hold a man responsible for all the facts in every subject than it would be to expect him to be able to make all the manufactured articles on the market. It is within our rights, however, to insist that he should realize when facts fail him, and also that in such cases he is either not capable of passing judgment at all or his conclusions are only tentative and subject to revision on the presentation of further evidence.

Chemistry offers abundant opportunity for training the mind in the examination of evidence, and also for the forming of judgments, both tentative and final. The processes of thought are often very complicated, because of the element of uncertainty that enters into the premises upon which the deductions are based. So far in the pupil's career he has been accustomed to reason from axioms more or less self-evident, but has rarely been required to test the accuracy of funda-

mentals before arriving at his conclusion. A few illustrations will make this quite clear. In geometry the student begins with axioms, and the result follows logically therefrom. Witness the following example: The sum of the angles made by three straight lines completely enclosing a finite plane surface is equal to two right angles. This is of the nature of an imperfect induction, because there is an infinite number of such triangles possible. Yet the proof of a single case serves to make the pupil confident of the universal truth of the proposition. In an attempt to apply a similar line of argument to a case in chemistry difficulties are liable to be met with. For instance, the pupil who has been working with solutions of copper salts, such as the chloride, sulphate, nitrate or acetate, would very likely come to the conclusion that all copper salts give a blue color in water and a precipitate with hydrogen sulphide. His conclusion is, of course, fallacious, for if sufficient potassium cyanide is added to the solution of any of the above-mentioned copper salts, the blue color disappears, and hydrogen sulphide fails to give the anticipated precipitate.

The following subtle case is even more disconcerting to the young pupil. Experience leads him to believe that the rate of a reaction (rate being defined as the amount changed in the unit of time) is proportional to the temperature. For example, if he heats copper, it oxidizes more rapidly than it does at room temperature. Lead, iron and tin behave similarly. Barium oxide heated to 500 degrees centigrade obeys the same law, and takes on oxygen to form barium dioxide. If the law holds up to 500, it should hold at 1000 degrees; yet the pupil will find that it is impossible to form any large amount of barium dioxide at this temperature. In the light of this experiment it would be natural for him to suppose that the law had some exceptions. A little more experience, however, will teach him that the law is probably of universal application, and that the case of barium oxide and dioxide is a striking illustration of its validity. The explanation of the unexpected result is that the decomposition of barium dioxide is also proportional to the temperature, but that the temperature co-efficient of the decomposition is much greater in the neighborhood of 1000 degrees than that of the formation. As a

consequence, barium dioxide is broken up at high temperatures just as fast as it is formed.

We see from these considerations that deductions in chemistry are often fraught with great danger, because the premises are so frequently of the nature of imperfect inductions. Viewed from the standpoint of the pupil's training, this uncertainty should be a blessing in the hands of the skillful teacher.

The foregoing paragraphs have been leading up to the question of the choice of experiments for laboratory work. Many teachers contend that they should be kept as simple as possible, with but a single object in view. That this is desirable at first can scarcely be doubted by anyone. It is not so clear, however, just how far this policy should be continued. How is the pupil to learn to test his premises if we do not frequently give him the opportunity? Much experience has convinced the writer that continued plain sailing and simple examples tend to make the pupil unguarded in his conclusions, and lead him to form hasty judgments. The following experiment is a very good instance of a correction for this error: The pupil is given directions to melt, but not boil, potassium chlorate and test for oxygen with a glowing splinter. Next he is to add a portion of manganese dioxide and again test. Oxygen is now given off copiously, and most pupils conclude at once that manganese dioxide is thus proved to be a catalytic agent. A little reflection soon convinces them that from this experiment, as they have performed it, there is no proof as to whether the potassium chlorate, the manganese dioxide or a chemical reaction between the two is responsible for the evolution of the oxygen. It would be very instructive to test the effect of experiments of this type on the ability of the pupil to analyze carefully the evidence before him.

As has been already pointed out, another very common source of error is the failure on the part of the pupil to interpret results in the light of his previous knowledge. In fact, this is one of the most difficult problems the pupil has to face in his struggles with the subject. There are usually so many facts that must be brought to bear on the question at issue that the pupil becomes confused. For instance, he will prob-

ably conclude that hydrochloric acid contains free chlorine because starch paper turns blue if held in the vapors from a boiling solution of hydrochloric acid and potassium iodide. He forgets that hydriodic acid is not very stable and breaks down at the temperature at which he made his tests. Experiments of this nature involve reasoning from analogy, a very effective agent or a dangerous pitfall in argument, depending upon the ability of the reasoner to use it judiciously or otherwise. These experiments are splendid opportunities for correlation. Their effect where the pupil is called upon to concentrate many points of view on a single issue should be systematically investigated.

Another problem for research is whether the pupil should clearly understand the object before he begins the experiment or be left to conclude what the purpose was from the results he obtains. The scientist presumably knows what he is trying to show by his experimental work; but this knowledge often tends to make the pupil prejudiced, and therefore inclined to misinterpret his results.

Imagination.

Imagination, although differing somewhat in kind and application, is just as essential for construction and invention in science as it is in literature or art. Chemistry is fertile soil for the growth of this important capacity, because of the many opportunities for visualizing, and for constructive problems. By constructive problems is meant those where the pupil is required to suggest the method of procedure and the apparatus necessary for the illustration or proof of the point under discussion. They need not be difficult, but should make demands upon the ingenuity of the pupil. This method of teaching is doubtless more time-consuming, as far as the accumulation of facts is concerned, but it is a question whether the pupil has not gained more at the end of the course. Data on this point are badly needed, especially in the case of pupils who have little or no natural ability for invention. While they are very much in need of developing in this direction, it may be that the headway made would not be great enough

to warrant the employment of so much valuable time. As to the type of the constructive problems, the pupil might be asked to suggest possible experiments to illustrate or prove the point under consideration. The difficulties in the way could be pointed out by the teacher or by other pupils, and means of overcoming these difficulties devised by the class. Variation in the apparatus employed for the same experiment offers opportunities for the development of mechanical inventiveness.

In the matter of visualization it would be of value to know what would be the effect of requiring the pupils to predict and describe before the experiment is performed what they expect to see during the operation. It is quite possible that many pupils would have such fixed preconceptions that they would lose more in open-mindedness than they would gain by the play of the imagination; but if proper guidance is given by the teacher, this should prove a valuable exercise to develop the power to visualize constructively. Another device to cultivate visualizing would be to have the pupils construct apparatus from description without the use of sketches or diagrams.

The Spirit of Investigation.

One of the difficulties in laboratory work with young pupils is the fact that most of them prefer the striking or spectacular. They would much rather make an explosion, or silver a mirror, than experiment with the object of deciding some disputed point. The desire to find out for himself and the willingness to examine the evidence are attitudes of mind so important that their development in the pupil is worthy of the most strenuous efforts on the part of the teacher. Such researches as have been suggested under the preceding heading would go far to reveal the best means of securing these attitudes of mind.

COMMUNICATIONS AND DISCUSSIONS.

AN EXPERIMENT IN THE LEARNING OF FOREIGN WORDS.

The purpose of this experiment was to ascertain the relative efficiency of different methods of learning the meaning of words in a foreign language. The two methods tested were: (a) Reading to get the meaning and looking up the unknown words in a dictionary as encountered; and (b) looking up in a dictionary words encountered in a formal list. The factor really tested was the associational influence of the context in fixing the meaning of the new words encountered.

The language selected for the experiment was German. The subject was fifteen years ago quite familiar with this language, spoke it with some hesitation, wrote it quite freely, and read it rapidly and without difficulty. His use of it then, however, was almost wholly literary, hardly at all scientific. He discontinued all use of it from 1899 to 1906, and since then has used it only in occasional and very limited bits of scientific reading. He finds himself reasonably ready with the inflected system and with the movement and structure of sentences, but slow and hesitating in the actual process of feeling his way through the meaning, and markedly deficient in vocabulary. He often sees the grammatical structure of a sentence quite clearly, without being able to fit it logically into the context. He believes this is not entirely due to gaps caused by ignorance of the content of individual words, but partly to the imperfection of the complex of associations involved in the web of discourse, through long discontinuance of practice.

The two methods used in learning words have been described. In both methods the meanings were merely attended to with some energy once. There was no repetition and no writing of meanings, except in a mechanical sort of way for purposes of record and without vivid attention to the meaning. It is believed that these writings had a negligible effect on the fixing of the meanings in memory.

If a word was encountered a second time in contextual learning, record was made as to whether it was remembered or not. If not remembered, it was then looked up again. A short time after finishing the reading (from one-half to two hours), after an interval of some other occupation, the list of words looked up was read to the subject by an assistant, with the omission of such as had already been encountered a second time. Record was made as to whether he remembered them. Thus there was in the main fairly secure provision that each word should be encountered twice, and only twice, on the first day of the experiment involving it. If the subject did not remember the word on the second presentation, its meaning was told to him.

TABLE 1.

Results of Learning Foreign Words in Context and in Lists.

(Percentages are based on total number learned.)

	I context first trial.		II list first trial.		III list second trial.		IV context second trial.		I and IV context both trials.		II and III list both trials.	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
Words learned.....	17	....	17	....	17	....	17	....	34	....	34	....
Words remembered 2d presentation (same day).....	15	88.2	14	82.4	13	76.5	13	76.5	28	82.4	27	79.4
Words remembered after 24 hours.....	17	100.0	15	88.2	14	82.4	15	88.2	32	94.1	29	85.3
Gain on 3d presentation	2	11.8	1	5.9	1	5.9	2	11.8	4	11.8	2	5.9
Advantage in method... On 2d presentation.....									1	3.0		
Advantage in method... On 3d presentation.....									3	8.8		

In the learning of lists of words (Categories II and III, Table 1) an effort was made to keep all the conditions of the experiment identical with those in the learning of categories I and IV, except that the words were not encountered in context. Lists were prepared by an assistant familiar with German; the subject looked over these lists and struck out those which he knew or thought he knew. The remainder furnished the material presented in the lists.

After each series of words had been presented the second time, twenty-four hours was allowed to elapse. The words were then again presented and a record made. After this third presentation the succeeding series was presented for the first time.

Four series of words were used; the first and fourth chosen from

the context, and the second and third from formal lists. No practice effect appeared, and this feature is consequently not included in Table 1, which gives the results of the learning in terms of the number and percentage of words remembered on the second and third presentations.

TABLE 2.

Effect of Practice in Reading on the Guessing of Word-Meanings.

	Total words.		Unknown words not guessed.		Unknown words guessed.	
	No.	%	No.	%	No.	%
First trial	266	...	17	6.4	19	7.1
Second trial	399	...	20	5.0	11	2.2
Difference	133	50.0	..	1.4	..	4.9

In the reading (I and IV, Table 1) account was also taken of the time, the total number of words read, and the number of words whose meaning was guessed and found upon reference to the dictionary to be correct. These results are set forth in Table 2. These words are not included in the lists given in Table 1. For the sake of greater accuracy in comparison, the reading was continued for exactly one hour each time. The material read was from Pohlmann, Beitrag zur Psychologie des Schulkindes, Pädagogische Monographien 13: 3, par. 3ff. The time of day was the afternoon, varying usually from 1:30 to 4:30. One list was looked up and the test made after 7 P. M. The experiment proceeded without long interruption from August 14 to August 25, 1914. The subject meanwhile read no German except in connection with the experiment.

At the second reading (on August 24) it was found that twenty unknown words were encountered within the hour. These are all counted in Table 2, but for convenience of comparison only the first seventeen of those words were selected for further test, as that number had been made the basis of computation in the other tests.

In spite of the small number of words used, the results appear to be perfectly definite and unambiguous in meaning. Words encountered in context were remembered in both trials decidedly better than words encountered out of context. The advantage in favor of the context method is 3 per cent. of the whole number. That is, according to these results, 3 per cent. more of the total number of new words encountered will be recognized when next seen, if the new words were encountered in context, than would be the case if they were listed and looked up. Not only so, but the advantage is three times

as great for the recognition of the word after a twenty-four-hour interval. The experiment then is decidedly favorable to the much-decried text-and-dictionary method of enlarging one's vocabulary in a foreign language.

An interesting by-product of the experiment comes out in Table 2. It was noted in the discussion of Table 1 that the practice effect upon retention of words was negligible; that is, the percentage of words remembered on the second presentation after learning by either method showed no gain on the second trial by that method, and the gain on the third presentation was absolutely constant in the two trials by each method, being 11.8 per cent. for contextual learning and 5.9 per cent. for learning in lists.

Practice effect may then be eliminated as a factor in Table 2, so far as it concerns the number of words retained. We find there that the amount read per hour increased 50 per cent. on the second reading; that the percentage of unknown words not guessed at sight falls off 1.4 per cent. of the whole number of words, and that the percentage of words whose meaning is not surely known, but is guessed correctly, falls off nearly 5 per cent. of the whole number.

This means a marked gain not only in the rate of reading, but in sureness of association and confidence through consciousness of control of the process. It is believed that the difference between words which were really new to the subject and words which had previously been known but had been partially forgotten was becoming decidedly clearer. A distinction was also recognizable between unfamiliar words whose meaning was inferred from their formation (as Ursache, annähern, etc.) and words whose roots were unknown to the subject, but whose meaning was correctly inferred from the context. Latin synonyms also came spontaneously to the subject's assistance in many instances.

The experiment is an easy one to perform, and valuable for the teacher of foreign languages. It may be varied in many particulars, to test one method or another, or to isolate the influence of context, etymology, knowledge of other foreign languages, and various other factors, in increasing one's vocabulary. It cannot but throw light upon the processes through which the pupil passes, and give the teacher both sympathy with his difficulties and a sound technical resource for his aid.

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AN EXPERIMENTAL INVESTIGATION OF THE BOOK, LECTURE AND EXPERIMENT METHODS OF TEACHING PHYSICS IN ELEMENTARY SCHOOLS.[1]

This investigation was undertaken to obtain a basis for a judgment on the best method of teaching elementary physics. Three methods were employed (referred to as the book method, the lecture method and the experiment method), and the classes of the seventh and eighth grades of Public School 84—Boys, Brooklyn, were so divided that each lesson in science was taught to each class of the same grade by a different method. Upon the completion of the series of lessons the classes were tested by uniform tests, and thus the effects of each method were noted. Some tests were given after a stated interval in order to ascertain how the impressions left by each of the methods were affected by time.

The series of experiments extended over the first and second school terms of 1911. During the second term many of the experiments of the first term were repeated for purposes of verification. Altogether there were 30 experiments in which the lecture, book and experiment methods were compared. The total number of boys that participated in these experiments was about 500. The average age was 13 years 10 months. The total number of test papers corrected was 3280. To this number the book method classes contributed 1114, the lecture method 1072, and the experiment method 1094. In all, about 18,500 individual question were answered and corrected.

The sum totals of the average per cents that the book, lecture and experiment methods attained are as follows: Book method 1555, lecture method 1891, experiment method 1949 total per cents. On the basis of *average per cent. attainments,* then, the experiment method produced the best results. The lecture method, a close second, is only 58 units below the experiment method, while the book method is far behind.

The experiment method produced the highest average per cents in 16 of the 30 experiments. In four of the experiments the average per cents were the same as in the lecture method. In only one experiment did it take third place. In two experiments it tied with the book

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[1]Author's abstract of a thesis for the Ph.D. degree at New York University. The original thesis, of which this abstract presents a fragmentary summary, is a typewritten manuscript of 386 pages, and may be consulted for further details at the library of New York University.

method for second place. In the remaining seven experiments the experiment method takes second place.

The lecture method produced the highest average per cents in 10 of the 30 experiments. In four the per cents were the same as in the experiment method. In 13 experiments it takes second place. In three experiments it takes third place.

The book method did not produce the highest average per cent. in any experiment. In one it tied with the experiment method for first place, in three it was distinctly second, and in one it tied for second with the experiment method. In the remaining 25 experiments it produced the lowest average per cents.

Eight of the thirty experiments are repetitions of the corresponding experiments of the term before. In the experiment method four first term conclusions are confirmed and four are not. In the lecture method three are confirmed and five are not. In the book method seven are confirmed and one is not. This indicates that the conclusions (as far as these eight experiments are concerned) regarding the book method are firmly established. The conclusions regarding the experiment and lecture methods (as regards these eight experiments) are open to doubt. Further extended investigation might be profitably undertaken.

Twelve of the experiments are 'interval' experiments, *i. e.*, with the test separated by a stated interval from the lesson. In eight of these twelve experiments the experiment method came out first; in two it tied with the lecture method, and in one with the book method for first place. In one experiment it takes second place.

The lecture method attained first place in one of the 12 interval tests; in two it tied with the experiment method for first place. Seven times it attained second place and twice third place.

The book method tied with the experiment method for first place once, and once it attained second place. In the remaining 10 experiments it was third.

This indicates that the impressions left by the experiment method are the most permanent; those left by the lecture method less permanent, and those left by the book method least permanent.

A "combination method" (experimental demonstration plus notebook work) was compared with the other methods in five experiments. In four of the five experiments its average per cents were far below those of the lecture method, in two experiments its average per cents

were much below those of the experiment method, and in two experiments its average attainment was about as good as that of the experiment method. Although we have only five experiments from which to draw our conclusions, the value of notebook work seems to be seriously discredited. Further experimentation in this direction is highly desirable.

The total time consumed by each method is: Lecture method, 121 minutes; experiment method, 143 minutes; book method, 232 minutes. This would mean that the book method is very wasteful of time; the experiment method less so, and the lecture method least so. An undue proportion of the total time in the book method comes from experiments involving quantitative work, to which three full periods were allowed. Excluding the exceptional cases, we find that, as far as the actual teaching of a lesson is concerned, the time consumed by each method is about the same. This leaves out of consideration the time spent by the teacher in preparing lessons. From the teacher's point of view, the methods in the order of least time consumption are: 1st, book method; 2d, lecture method; 3d, experiment method.

"Interest is the mother of attention." Without interest there is no attention and without attention intelligent work cannot be done. The book method of teaching elementary science did not prove interesting to the boys. Only in rare cases was curiosity aroused on account of the novelty of the method.

On the other hand, the lecture method proved to be most interesting. It seems that the element of personality is the important feature of this method. Not one case is recorded where this method failed to arouse and hold the attention. In experiments where the work was largely quantitative in nature the lecture method far excelled the other two. This was largely due to the ease of grasping clear explanations. The boys were not aroused to superior thinking. but merely remembered and imitated the explanations given them.

It is hard to say whether or not the experiment method was as interesting as the lecture method to the boys. Certain it is that in the lecture method attention and interest were directed to the essentials of each lesson, while in the experiment method such interest and attention were necessarily divided between the lesson, itself, and the apparatus that was used.

Of the three methods. the book method was the most fatiguing. Mind-wandering, yawning, staring, stretching, inattention and list-

lessness were invariably noted. The lecture and experiment methods had about an equal share in reducing fatigue to a minimum.

It was demonstrated, again and again, that not only are boys of elementary school age unable to get the thought by means of symbols from the printed page, but that even simple diagrams did not prove of much benefit. If the pupils remembered anything, they remembered words, and not ideas. In several cases a simple diagram was reproduced without the slightest conception of its significance. On the other hand, the concrete and detailed presentation in the experiment method proved of great aid in reproduction. In other words, concrete memory images were reproduced more readily than verbal or auditory memory images.

The book method failed to produce good results either in thought or in memory work. It cannot be said, however, that the experiment method and lecture method were particularly successful in arousing the boys to original thought. Judging from the character of the answers that were given by the classes, it is safe to say that the book method class depended too much upon memory. If the exact statement of the book was forgotten, the answer was usually incorrect. There was no attempt to reach an answer through a process of sound reasoning. The ingenious "inventions" that the book method class frequently resorted to are not indications of sound reasoning. On the other hand, the lecture and experiment method classes, especially the latter, showed more power of independent thought and self-reliance.

Further points emphasized by various aspects of the experiments were that repetition of subject-matter, with an extended intervening period for study, results in a marked increase in efficiency as indicated by the tests; that the use of books in connection with science work helps the boys in the power of expression and has a wholesome effect upon the spelling of scientific terms, both new and old; that poor experimental demonstration is detrimental to efficient teaching, and that a teacher's judgment regarding a class with which he is familiar is usually correct.

The vote of the eighth-year boys showed that the experiment method was by far the most popular, receiving a total of 88 votes. The next in popularity was the lecture method, 23 votes, while the book method received only 11 votes.

Conclusions.

1. On the basis of efficiency as measured by percental attainments, by lasting impressions on the minds of elementary school pupils, by persistence in memory, by encouragement of independent thought and self-reliance, and by popularity among the pupils the three methods rank as follows: First, experimental method; second, lecture method; third, book method.

2. An the basis of minimal time consumption in the actual teaching of the lessons, of arousing and holding interest and attention, and of the minimal expenditure of mental and physical energy they rank as follows: First, lecture method; second, experimental method; third, book method.

3. On the basis of minimal time consumption by the teacher in the preparation of the lessons, they rank: First, book method; second, lecture method; third, experiment method.

4. The amount retained in thought work, as well as in memory work, in elementary science is inversely proportional to the length of time elapsing between the presentation and the test.

5. No particular hour of the day or position in the general program need be reserved for elementary science.

6. Carefully-written notebook work and neatly-drawn diagrams of science apparatus do not increase the pupils' knowledge of elementary science.

7. The work in elementary science must be concrete, and must be based on the daily experiences and observations of the pupil.

8. Elementary science in elementary schools should be largely, if not entirely, qualitative, and not quantitative.

9. As regards elementary science, elementary school pupils cannot get the thought from the printed page. Simple diagrams are of no material aid.

10. The book method of teaching elementary science might be used with fairly good results, provided the class were exceptionally bright.

11. Pupils who are taught by the book method show superior ability in the power of expression, and in the spelling of new scientific terms, as well as of familiar old terms.

12. Since the experiment and lecture methods approach each other in so many respects, either one may be profitably used. Each produces good results. An ideal method might result from a combination of the two.

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ABSTRACTS AND REVIEWS.

ISAAC EMERY ASH, PH.D. *Fatigue and its Effects upon Control. Archives of Psychology*, No. 31, June, 1914. (University of Wisconsin Contributions to Educational Psychology, No. 1.) Pp. 61. 60 cents.

The author presents a general survey of the problems of physical and of mental fatigue, which is clear and in good perspective, though by no means exhaustive. From this survey he argues "that one of the chief symptoms or characteristics of natural fatigue, and one which represents most uniformly the relative effects of varying amounts of exertion, and hence furnishes the most reliable basis for estimating fatigue, is a loss of control in the execution of specific movements or in the performance of particular and highly specialized mental functions." This principle is quite neatly brought out by the author's experiments with muscular fatigue, which indicate that when curves produced with the ergograph decline as the work of lifting continues, there is really a corresponding 'spilling over' of energy into other muscles; thus, for instance, curves produced by connecting the second and fourth fingers with the graphic registration begin to augment in excursion when the curve produced by the third finger begins to decline in excursion. In short, the primary phenomenon is loss of control over the direction of muscular energy.

More interesting is the transference of this idea to the measurement of mental fatigue. The procedure finally developed is that of recording the rate at which various ambiguous figures (geometrical optical illusions, like the cube, the staircase, the pyramid) can be voluntarily reversed in perspective. Dr. Ash argues, in other words, that the effortful seeing of these figures, first in one perspective, then in another, involves a process of central control or direction of the exercise of a mental activity analogous to the control of a voluntary movement physically. The results obtained from this experiment seem to the reviewer almost too good to be true; they indicate that, once practise has been discounted or eliminated, the rate of reversal of perspective affords a very quick and reliable index of mental efficiency.

The absolute rate of reversal varies decidedly with different individuals, but for each individual the rate appears to vary in close correspondence with mental condition. The author presents numerous tables which show the measurement of rate of reversal at different hours of the day, before and after periods of mental activity of various sorts and durations, including measurements of the rate of recovery from such mental activities.

It goes without saying that Dr. Ash's results should be subjected to trial by other experimenters and upon children as well as adults and perhaps by various modifications of technique before they are taken as conclusively demonstrated. However, the monograph is, in our judgment, a suggestive and interesting contribution, and none the less pleasing because it has been presented in a clear and concise literary style. G. M. W.

ELNORA WHITMAN CURTIS. *The Dramatic Instinct in Education.* Boston: Houghton Mifflin Company, 1914. Pp. 246. $1 net.

A brief review can give no adequate impression of the interest and value of Dr. Curtis' work. In the opening chapters there is a wealth of data on the present condition of children's theaters in this country and Europe, and on the effects which they have on education. America is shown to be far ahead of Germany in the dramatic training of the child as a part of his education. Participation as a child in a well-directed play is shown not only to impress the lesson of the play, but to render the individual more capable of appreciating acting. If the reflex imitation theory of art appreciation is true, such participation would seem to be necessary. Instead of inducing children to elect a stage career, the children's theater has the effect of disillusioning them.

One reads the chapters on dancing, moving pictures, marionettes, pageantry, etc., with a feeling that the discussions are sane and well-balanced. In no sense is the treatment pedantic; instead, there is a crispness and novelty on every page that is wholly refreshing and satisfying. Even the chapters on play and story-telling transcend the usual treatment of these topics, in that they are written from the standpoint of the dramatic tendencies of the child.

The chief criticism to be brought against the book is that the author apparently assumes in both title and discussion that there is in the original nature of the child something as definite as a dramatic in-

stinct. The need for and the joy derived from dramatic, imitative, creative action is beyond question. To say that there is a dramatic instinct is to assume more than is necessary either to explain the widespread occurrence of such behavior, or to justify the claim that it can be made an effective educational agent. But this assumption does not detract materially from the merits of the work. The book is based upon and made up largely of authenticated facts which the reader may interpret in the light of any theory he chooses. As such, it rises above the work of an enthusiast or a propagandist and shows the marks of a scholar worthy of recognition among scholars.

L. W. SACKETT.

The University of Texas.

PASTOR DR. WITTE. *The Education of Karl Witte, or The Training of the Child.* Edited, with an introduction by H. Addington Bruce. Translated from the German by Leo Wiener. New York: Thomas Y. Crowell Company, 1914. Pp. xl, 312. $1.50 net.

It is just a century since this book, the buried and resuscitated forerunner of several recent treatises of similar import, was printed and published and—forgotten. We seem to owe its revival to the ingenious and pervasive instinct of Addington Bruce for the discovery of hidden springs of living refreshment; his "hazel twig" and its productions are well known to most present-day readers of the magazines.

It is not very difficult to believe the statement of the editor in his Introduction, that "in its original form it is a book which, to employ the quaint but extremely expressive German phrase, does not allow itself to be read," but it is none the less of considerable importance in the history of modern pedagogy. The latest of the books treating of intensive education begun at a very early age (Mrs. Stoner's "Natural Education") is of the same general nature, and both of these suggest "Emile" and Pestalozzi and Berle and Sidis.

The editorial task must have been a grievous one and worrisome to a degree, for only a fraction of the original thousand pages of matter printed by the fond Pastor Witte of Lochau appears in this volume; but even here it is related, for example, how Karl's good mother weaned him, and also at least one of his narrow escapes from the grave before nine months old—"for Mrs. P. G. at R. [kind but mis-

guided dietician!] had fed him with blood sausage while still being nursed."

Another aspect of this descriptive narrative of the precocious education of a child is even more prominent than in most similar American accounts, namely, the great fatherly pride in his offspring's attainments ahead of the conventional time. No small portion of the book is taken up by evidences of his attainments. Most people, according to Pastor Witte's statement, believed that Karl was born with unusual endowments of mind, but his father denied this and early and late assumes, with his wife, most of the credit for the boy's precocious accomplishments in efficiency. This very point, here as in similar books, constitutes the only doubt that appears at all about the pedagogical validity of the methods of intensive education.

The translation is an excellent one (better, perhaps, than some of Professor Wiener's other work), and makes easy reading. The book lacks an index, and this lack the twenty-three capter headings do not supply.

GEORGE V. N. DEARBORN.

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THE
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EDITORIAL.

THE POINT SCALE IN MENTAL MEASUREMENT.

Those who gave careful attention to the article on the applications of the Point Scale by Professor Yerkes and Miss Anderson in the March number of this JOURNAL could not fail to be impressed with the possibilities of the method. While the Point Scale is founded upon the Binet Scale, in that most of the twenty tests are copied or derived from Binet, the new plan has several distinct advantages over the old and represents a noteworthy advance in mental measurement. In spite of the generally favorable attitude that has been manifested toward the Binet Scale and the principle of age tests which it embodies, every investigator who has used it has criticized either the selection or the location of some of the tests. The method of determining mental age by it is admittedly crude, and the results become increasingly unreliable in the higher years. The Binet Scale is standardized at the start, and any rearrangement of the tests or insertion of new tests involves a complete reorganization. There is no way of ascertaining the relative value of the tests with reference to each other, or of evaluating new tests in terms of old ones. No pro-

vision is made for differences in quality of responses, but the judgments must be made on the all-or-none principle of "passed" or "not-passed."

In the Point Scale a convenient number of representative Binet tests is given to all subjects, and the response to each test is evaluated on the basis of a certain number of "points" out of a total of 100. It is true that the selection of the tests and the initial assignment of points to them is just as arbitrary as anything in the Binet Scale. With extended use, however, it will be possible to obtain not only norms of performance in each test for groups differing in age, sex, race and social status, but also the value of each test with reference to the others, and the number of points each should have of the total 100. The Point Scale, further, allows the use of statistical methods in determining the amount of variation in the responses to each test, and thus furnishes an index of the test's diagnostic value.

With the continued use of the Point Scale and the accumulation of a sufficient amount of data, it will be possible to assign a numerical value to each test as a measure of intelligence, just as Buckingham has determined the value of each word in his spelling scale, and the summation of the points obtained by a given individual would afford a specific numerical indication of his intelligence. Such an absolute scale, once established, could be extended indefinitely, each new test being evaluated in terms of those already used. Tests of any degree of difficulty and of any type of demand upon the individual could be introduced and their value established in comparison with the tests already standardized. To determine the intelligence of a given subject the examiner would select from the list a number of tests that he considered best adapted to the purpose in hand, would ascertain what the subject could do in these tests, would give him a corresponding numerical rating, and would compare the result with various norms previously obtained. Such a program may appear somewhat Utopian at present, but the vista of cumulative investigation opened up by the Point Scale is one of its most attractive features. J. C. B.

NOTES AND NEWS.

It is interesting to note that colleges and universities are beginning to take the work of teaching seriously, and are endeavoring to grapple with some of the problems involved. New York University, for example, announces a series of four conferences on the pedagogy of higher education, in which the deans and professors of all divisions of the university are invited to participate The topic for consideration at the final conference is "The value of method in college instruction and the pedagogical preparation of college instructors."

At the University of North Carolina the School of Education has been authorized by the faculty to confer the degree of bachelor of arts in education. Characteristic features of the course of study are the beginning of work in education in the freshman year and its continuance throughout the four years of the course in an increasing amount, and emphasis upon educational psychology, rural administration and supervision, high-school organization and teaching, and the observation and practice of teaching. The new course is established in recognition of the need of a more thorough and scientific training for prospective teachers.

The board of regents of the University of Michigan will ask the present Legislature for an appropriation of $750,000 with which to make additions to the library building and to erect a model training school for teachers. This school, if provided, will be administered by the department of education in the interests of the professional training of teachers. School superintendents throughout the State have long been advocating the need of such a school. They have contended that the graduates of the university who take up the profession of teaching are at present seriously handicapped by their lack of technical training as teachers. The movement in favor of this school has been fostered by the State Board of Education and the normal schools, as well as by the administrative officers of the high schools throughout the State.—*School and Society.*

Professor Lewis M. Terman of Stanford University is preparing a revision of the Binet-Simon Measuring Scale of Intelligence and a detailed guide for its use. The guide is based upon the examination of over two thousand children, and will be issued some time this summer.

Webster's New International Dictionary, published by G. & C. Merriam Company, Springfield, Mass., has been officially adopted or approved by all the States that take official action regarding dictionaries. Such action has been taken by thirty States, the District of Columbia, Alaska and the Philippine Islands. The American Book Company, by special arrangement with the Merriam Company, is issuing a series of shorter school dictionaries based on the New International for use in high and elementary schools.

The trustees of Teachers College, Columbia University, have appointed Prof. Paul Monroe as director of the School of Education and Prof. M. A. Bigelow as director of the School of Practical Arts.—*School and Society.*

Dean Herman Schneider of the University of Cincinnati and Superintendent William Wirt of Gary, Ind., have each received $10,000 from New York city for ten weeks' work in supervising the establishment of a system of co-operative vocational education in the public schools.

Dr. Walter Van Dyke Bingham, assistant professor of psychology and education at Dartmouth College, has accepted the position of professor of psychology and director of the Bureau of Mental Tests at the Carnegie Institute of Technology, Pittsburgh. The new bureau will co-operate with other agencies in controlling admissions, in advising students about their work, and in recommending students and graduates for positions.

Dr. J. Carleton Bell of the University of Texas will be a member of the faculty of the Summer School of the South, University of Tennessee, at Knoxville, this summer. He will give courses on "Child Behavior, with Especial Reference to the Kindergarten and the Elementary School," and on "High School Behavior," and will

conduct a series of round-table conferences for superintendents and principals on "The Practical Bearings of Experimental Studies in Education." Other members of the faculty from abroad will include Prof. Henry Suzzallo, Teachers College, Columbia University, and Dr. Albert E. Winship of Boston.

At Teachers College, Columbia University, Assistant Professors William H. Kilpatrick and Milo B. Hillegas have been advanced to the rank of associate professor, Dr. Thomas H. Briggs has been appointed associate professor of education, and Professors E. L. Thorndike, Charles H. Farnsworth and Frank M. McMurry have been granted leaves of absence for the year 1915-16.

Dr. Charles A. McMurry, director of the training department, Northern Illinois State Normal School, and superintendent of schools, De Kalb, Ill., has been elected professor of elementary education at George Peabody College for Teachers, Nashville.

Dr. James L. McConaughy, professor of education, Bowdoin College, has been appointed professor of secondary education and executive secretary of the committee on admissions at Dartmouth College. Dartmouth has withdrawn from the New England college entrance examination board, and will endeavor to establish a better understanding between the schools and the college than now prevails.

PUBLICATIONS RECEIVED.

(Notice in this section does not preclude a more extended review.)

LEONARD P. AYRES. *A Scale for Measuring Quality of Handwriting of Adults.* New York: Russell Sage Foundation, 1915. Pp. 11.

This is an extension of the author's scale for measuring the quality of handwriting of school children, and was constructed at the request of the New York Civil Service Commission. Two thousand eight hundred and seventeen samples of adult handwriting were secured from various commercial schools, from the files of the Civil Service Commission, and from correspondence to the newspapers. Each of these samples was rated by ten judges on the basis of the earlier scale, and 24 samples were selected in such a way that there were eight groups of three samples each. Each group contains a sample of vertical writing, medium slant and extreme slant, all three having the same average rating in quality. In the use of the scale the author recommends that the samples to be rated should first be sorted into piles of about the same quality. The papers in each pile are then carefully compared with the scale and with the other papers in that pile to make sure that samples have not been included in the pile that might be assigned to the next higher or lower piles. The scale will be a valuable supplement to the author's scale for children's handwriting.

AUGUSTA F. BRONNER. *The Comparative Study of the Intelligence of Delinquent Girls.* Columbia University Contributions to Education, No. 68. New York: Teachers' College, Columbia University, 1914. Pp. 95. $1.00.

The problem of this study was to determine the intellectual status of a group of delinquent girls as compared with the intellectual status of several other groups that represent varying degrees of education and that are engaged in various occupations requiring varying degrees of intelligence and ability. Four groups were tested: group one consisted of thirty girls between sixteen and twenty-two years of age in the detention home maintained by the New York Probation Association; second, the college group; third, the evening class group; and fourth, the domestic service group. The tests employed were easy opposites, hard opposites, memory of words, memory of passages and the Ebbinghaus completion tests. In addition the Fernald ethical discrimination tests and several ethical completion tests were used. The results of the investigation quite negative the view that delinquency in behavior is the outcome of mental deficiencies.

J. C. BROWN. *Curricula in Mathematics.* Bulletin No. 619, Washington: Bureau of Education, 1915. Pp. 91.

This monograph surveys the courses in mathematics offered in the different countries represented in the International Commission on the Teaching of Mathematics. The author first presents the general arrangement of the courses in typical schools of the different countries. The work in mathematics is then taken up by school years from the first to the thirteenth. There follow a graphic representa-

tion of the work in mathematics in these countries, a comparison with that done in the United States, and a selected bibliography.

Care of the Health of Boys in Girard College, Philadelphia, Pa. Bulletin No. 614, Washington: Bureau of Education, 1914. Pp. 20.

Perhaps the most striking thing about this monograph is the description of the work of the dental department, showing the individual record cards of pupils treated, and eighteen plates illustrating types of dental defect.

J. Crosby Chapman. *Individual Differences in Ability and Improvement, and Their Correlations.* Columbia University Contributions to Education, No. 63. New York: Teachers College, Columbia University, 1914. Pp. 45. 75c.

The fundamental problem in this investigation is whether there is any such thing in mental achievement as general improvability. Will the individual who gains rapidly in one measured trait gain with corresponding rapidity in all similar traits? The author analyzes the composite practice curves, and computes the correlation between initial abilities in various functions; between initial and final abilities in these functions; between improvability in one functon and improvability in others; between initial ability and improvability in each function; and between efficiency and accuracy in each function. The subjects were twenty-two students, and the tests included color naming, cancellation, hard opposites, addition, and mental multiplication. The author finds a small but constant correlation between initial abilities, and a very slight inter-correlation between improvements.

Maria B. Chance. *Self-Training for Mothers.* Philadelphia: J. B. Lippincott Company, 1914. Pp. 278. $1.25.

A series of simple, homely talks on such subjects as the mother's duty to herself, health, nursery days, child discipline, responsibility, school days, children's amusements, children's books, the home and the child, and when the children marry. There are many interesting and pertinent anecdotes, and the book contains much sound common sense. There is little or no evidence of a psychological background.

John M. Coulter. *The Fundamentals of Plant Breeding.* New York: D. Appleton & Co., 1914. Pp. xiv, 347. $1.50.

The practical aim of this book is to increase the food production of the United States, and in order to do that the author deems a much more extensive knowledge of plant breeding essential. We are only at the threshold of the possibilities which may be realized by the application of the principles of scientific agriculture. The work deals with variation in plants, the theories of natural selection and mutation, Mendel's Law, recent work in genetics, the role of hybrids, the production of drought and disease resisting varieties, the search for new plants, and the activities of the federal government in developing agriculture. The book is addressed to those who

wish a simple statement of evolution and heredity, information concerning recent developments in plant breeding, and a general introduction to the fundamental principles underlying agriculture. It should be in the laboratory of every rural agricultural high school and of every teacher who comes in contact with agricultural interests.

PERCY E. DAVIDSON. *The Recapitulation Theory and Human Infancy.* Columbia University Contributions to Education, No. 65. New York: Teachers' College, Columbia University, 1914. Pp. 105. $1.00.

Chapter two gives an excellent history of the recapitulation theory in biology. The author concludes from this survey that there is very little ground for the acceptance of recapitulation in biology in any other sense than as a practical synonym for heredity. A careful examination of the application of the theory to human infancy reinforces the author's distinctly skeptical attitude toward the whole question of recapitulation in genetic psychology.

The Fourteenth Year Book of the National Society for the Study of Education. Part One. Minimum Essentials in Elementary School Subjects. Standards and Current Practices. Chicago: University of Chicago Press, 1915. Pp. 162. 75c.

The year book contains the following papers: "The Minimum Essentials in Elementary School Subjects," H. B. Wilson; "Time Distribution by Subjects and Grades in Representative Cities," Henry W. Holmes; "Typical Experiments for Economizing Time in Elementary Schools," Frank E. Thompson; "Standard Vocabulary," Robinson G. Jones; "Standards in Rates of Reading," S. A. Courtis; "Selected Bibliography Upon Practical Tests of Reading Ability," William S. Gray; "Handwriting," Frank N. Freeman; "Spelling," Hugh Clark Pryor; "The Essentials of Composition and Grammar," James F. Hosic; "Current Practices and Standards in Arithmetic," Walter A. Jessup; "The Determination of Minimum Essentials in Elementary Geography and History," W. C. Bagley; "The Essentials of Literature," James F. Hosic.

The General Education Board—An Account of Its Activities, 1902-1914. New York: General Education Board, 1915. Pp. xv, 240.

This volume gives the first extended account of the activities of the General Education Board since its establishment. No report has been issued heretofore, because it was felt that the Board's work was experimental in character and that premature statements in regard to its efforts were to be avoided. The plan is, henceforth, to have reports of its work issued annually. There is an account of the history of the Board, its resources and expenditures, the boys' and girls' clubs it has fostered, its activities in behalf of secondary education, particularly in the South; its relation to colleges and universities; and its work in the interests of medical education, rural education and negro education.

LETA STETTER HOLLINGWORTH. *Functional Periodicity. An Experimental Study of the Mental and Motor Abilities of Women During Menstruation.* Columbia University Contributions to Education, No. 69. New York: Teachers College, Columbia University, 1914. Pp. viii, 101. $1.50.

Eight subjects—six women and two men—were given long series of daily trials with the tapping test, steadiness test, color naming and opposites test. The object of including the two men in the tests was to obtain control records for the interpretation of the results with the women. The conclusions after careful and exact analysis fail to show any mental or motor inefficiency in normal women during the menstruation period. The variability of performance is not affected by physiological periodicity. No regularly recurring period of maximum efficiency in each month is discernible. The results furnish no support for the statements frequently made by psychiatrists and others, and generally accepted by the public, that the menstrual period is a time of profound mental and physical disturbance. The author is inclined to think that these statements belong in the realm of pure myth.

FRANKLIN WINSLOW JOHNSON. *The Problems of Boyhood.* Chicago: The University of Chicago Press, 1914. Pp. xxv, 130.

A course in ethics for boys of high school age. The author recognizes the difficulty the Sunday-school has in retaining its hold upon the growing boy, and believes that the public high school should do something in the way of formal instruction for meeting the needs of the boy's moral development. He holds that, if approached in the proper spirit, boys are thoroughgoing idealists and will welcome a systematic statement and discussion of the foundations of moral action. Some of the topics treated are custom, habit, honesty, property rights, gambling and betting, slang and profanity, clean thinking and speaking, the problem of sex, alcohol and tobacco, self-control and loyalty, citizenship, clubs and fraternities. In connection with each chapter there is a series of topics for class discussion.

Journal of Proceedings and Addresses of the Fifty-second Annual Meeting of the National Education Association at St. Paul, Minn., July 4-11, 1914. Ann Arbor, Mich.: Published by the Association, 1914. Pp. xii, 928.

This thick volume presents the problems and views of the common school superintendent, principal and teacher throughout the United States. It contains several papers of high value in the midst of much that is ephemeral. Papers of especial worth are the discussion between Prof. W. C. Bagley and Dr. David Snedden on "The Distinctions Between Liberal and Vocational Education"; Prof. E. L. Thorndike on "The Foundations of Educational Achievement"; Prof. Walter A. Jessup on "The Economy of Time in Arithmetic"; a symposium on "The Individual Child and His Individual Needs"; a paper

by S. S. Colvin on "The Attitude of the Child in Learning," and one by Clara Schmidt on "Reading and Arithmetic as Tests of Mental Ability."

FREDERICK JAMES KELLY. *Teachers' Marks—Their Variability and Standardization.* Columbia University Contributions to Education, No. 66. New York: Teachers College, Columbia University, 1914. Pp. 139. $1.50.

The author recognizes two problems in the assigning of marks—first, that concerning the average standard of achievement which should be expected of normal children of a given age and grade, and second, the distribution of ability within the normal group around that standard. The present monograph is concerned chiefly with the first of these problems. After a detailed survey of the literature on standards of marking in elementary schools, high schools and colleges, the author presents the results of a comparison of the marks given by teachers in New York State and the ratings of the same pupils in the Regents' Examinations. He then considers data derived from the application of the Courtis tests in arithmetic, the Thorndike Drawing Scale, the Thorndike Handwriting Scale, and the Hillegas Composition Scale. The author concludes that a given grade or mark means many widely different things to different teachers. In high schools and colleges the percentage of pupils which the various instructors fail varies from 0 to 28. He considers the effort of Courtis to standardize the ability to do single combinations in arithmetic as bad educational policy. The rating of papers by means of statistically derived scales, when the judges are unpractised in the use of the scales but are experienced in marking by the common methods, produces different results for different school subjects. In drawing the variability is greatly reduced by the use of the scale. In handwriting the variability is about equal with or without the scale. In composition the variability is somewhat greater with the scale than without it.

GEORGE TRUMBULL LADD. *What Ought I to Do? An Inquiry Into the Nature and Kinds of Virtue, and Into the Sanctions, Aims and Values of the Moral Life.* New York: Longmans, Green & Co., 1915. Pp. viii, 311. $1.50.

In this interesting book on the nature and sanctions of moral life the author throughout emphasizes the concept of evolution or development. The treatise is partly historical and partly practical, and is couched in such terms as to appeal to the person of average intelligence and education. There is first an inquiry into the origin of the conviction "I ought," and a discussion of one's intention of "being good" and of "doing the right thing." But "I ought" implies further "I can," and leads to the discussion of moral freedom. Other topics are the worth of moral ideals, virtues, custom and the moral law, questions of conscience, and the relation between morality and religion.

Latin and Greek in Education. Articles by Members of the University of Colorado Faculty. Boulder, Colo., Sept., 1914. Pp. 37.

This symposium on the value of Latin and Greek includes essays from representatives of psychology, chemistry, English, civil engineering, law, philosophy, biology, and medicine. Naturally only those opinions are included which favor the study of the classics. The chief arguments are their disciplinary value in training memory and the reasoning power, and secondly, the cultural value of acquaintance with classical ideals.

ARTHUR LEFEVRE. *The Organization and Administration of a State's Institutions of Higher Education.* Austin, Texas: Organization for the Enlargement by the State of Texas of Its Institutions of Higher Education, 1914. Pp. iv, 524.

This is an interesting, albeit curious, piece of work. The author is a trenchant writer and an industrious accumulator of data, but it would be difficult to find a work which contains so many fallacious or doubtful conclusions between its covers. Part one deals with the relations of the various State institutions of higher education to each other, opposes the idea of a central board of control, and urges correlation of the normal schools with colleges. The author advocates the support of higher institutions of learning by a definite tax. Part two, discussing internal organization, contains many references to the administration of other institutions, and sets forth the author's ideas as to the functions of the governing board, business management, the president, the faculty, the administration of the curriculum, and the activities of the students. The student of administration will find the book stimulating even if it is not reliable.

GERHARD R. LOMER AND MARGARET ASHMUN. *The Study and Practice of Writing English.* Boston: Houghton-Mifflin Company, 1914. Pp. v, 342. $1.10.

This is a simple manual for use in the upper elementary and early secondary grades. The chapter on established usages contains a discussion of punctuation, capitals, italics, syllabication, rules for plurals, possessives, and spelling. There is a chapter on the essentials of grammar and another on the use of language, a discussion of theme writing, an exposition of the forms of discourse, and a final chapter on correspondence. A valuable feature of the book is found in the extended bibliographical references at the close of each section and at the end.

ARTHUR LOVELL. *New Light on Consumption.* London: J. W. Williams, 1913. Pp. 140.

The author holds up to ridicule the futile attempts that have been made to cure consumption by the use of sera, tuberculin or other medical treatment. Imbedded in much bombastic and mysterious nonsense is the admirable suggestion of providing systematic instruction in how to breathe. In this the author goes one step farther than

the present-day advocate of the fresh air cure for consumption, for, as he forcibly points out, of what good is any amount of fresh air if it fails to come in contact with the surface of the lungs? The real importance of teaching people how to breathe is as yet only faintly appreciated by hygienists and educators.

ROBERT M. MACDOUGALL. *The Picture and the Text.* Reprinted from *Popular Science Monthly,* September, 1914. Pp. 270-283.

The author discusses the reasons for and the results of the increase in the proportion of illustrations to text in recent years. While he recognizes that illustrations have a legitimate place, he believes that the present over-emphasis on illustrations in books, magazines and public lectures fosters an attitude of mental laziness which has a demoralizing effect on our thinking. While this may be defended in literature and lectures designed for entertainment, the author protests vigorously against the abuse of illustrations and demonstrations in instruction. Particularly in scientific lectures is there danger of our deluding ourselves with the fond belief that we are mastering the principles of science in witnessing a moving picture show depicting the marvels of science or entertaining demonstrations of striking scientific experiments. The function of science is to explain, and explanations are logical rather than pictorial and require reflection rather than perception.

Mechanics of the Sewing Machine. Published by the Singer Sewing Machine Company, New York, 1914. Pp. 80. Issued in Co-operation with the Joint Committee on Physics of the National Education Association.

The monographs of this series are designed to enable high school teachers of physics to familiarize their pupils with the physical properties involved in modern machines. The booklet gives a detailed account of the history, construction and underlying principles of the Singer sewing machine.

A. C. MONAHAN. *The Consolidation of Rural Schools, and Transportation at Public Expense.* Bulletin No. 604. Washington: Buerau of Education, 1914. Pp. 104.

The author presents a history of the consolidation movement, a digest of state legislation on the subject, typical transportation arrangements with their cost, the cost of the consolidated school, its educational advantages, and various types of consolidated schools in different communities. There is an excellent working bibliography on the subject of consolidation.

ELSIE CLEWS PARSONS. *Fear and Conventionality.* New York: G. P. Putnam's Sons, 1914. Pp. xviii, 239. $1.50.

"Fear of change is a part of the state of fear man has ever lived in, but out of which he began some time ago to escape. Civilization might be defined, indeed, as the steps in his escape. What he now calls conventionality is a part of his system of protection against

change which he has begun to examine and, his fear lessening, even to forego." The author considers in detail many of the conventions of our modern life, and traces them back to the fears of primitive man. Instances of these are the rights of hospitality, introductions, castes, presents, calling, entertaining, conventions as to the relations between the sexes, family conventions, age classes, and a final chapter on an unconventional society. The book is full of thought-provoking material for the psychologist who is interested in the development of social customs.

SARA LOUISA OBERHOLTZER. *School Savings Banks.* Bulletin No. 620. Washington: Bureau of Education, 1914. Pp. 34.

An account of the origin and growth of the school savings banks movement and the methods of conducting the banks in different parts of the country.

Report of the Committee on the Academic Status of Psychology. American Psychological Association, Dec., 1914. Pp. 27.

The report includes data from 165 institutions collected from catalogues, and verified by letter to the responsible head in psychology at each institution. In 1894 there were 27 laboratories in the United States and Canada; in 1914 there were 88 such laboratories. There has been an increase in the value of the equipment from $30,000 to $163,000. The report gives a detailed account of the relation of psychology to other departments, especially philosophy and education; a study of the beginning course in psychology; a brief account of the advanced courses; a description of laboratory resources, and a discussion of the psychological program as a whole. The report is an interesting contribution to our knowledge of the present status of psychology.

WALTER HERBERT SMALL. *Early New England Schools.* Boston: Ginn & Co., 1914. Pp. ix, 401.

The object of this book is to furnish the material from which the reader may form his own conclusions regarding early New England schools. It is not history, but rather the materials from which history is written. It is to be regretted that the author did not live to see this labor of love, prosecuted for many years, appear in print. The book will be indispensable to all future historians on American education.

JOHN ELBERT STOUT. *The High School—Its Function, Organization and Administration.* New York: D. C. Heath & Co., 1914. Pp. xxiii, 322.

The author believes that with the recent remarkable growth of high schools, and the increasing confidence of the people in them, there is a need for the reorganization of the traditional curriculum and traditional methods of presenting subjects. This book is an attempt to state the principles that should guide us in the process of reorganization. Part one treats of the function of the high school,

including the factors which determine its function, the physical aspects of education, demands for vocational training and guidance, preparation for leisure, institutional and other types of social efficiency, preparation for college, and the education of girls. Part two treats of the organization and administration of the high school, taking up first the intellectual organization. Here the author urges the reorganization of the curriculum from a social standpoint. The center of this curriculum should be the social studies, and grouped around these should come the material sciences, the mother tongue, foreign languages, the ordinary vocational subjects, artistic and ethical education, and physical training. In the second section of part two the author lays emphasis on the need for social organization of the curriculum and the school, and discusses high school government, the material equipment of the school, and the preparation, aims and activities of teachers. The author has some interesting and pertinent remarks on the significance of the study of psychology in the training of teachers. He rightly emphasizes the necessity for the elimination of much of the psychology that is presented to prospective teachers, and lays stress on the learning and the teaching processes. It is true the author's ideas of the application of psychology to educational method are somewhat vague, but at least he demands that the psychological training should focus upon the needs of the teacher's work.

LEWIS M. TERMAN. *I. Suggestions for Revising, Extending, and Supplementing the Binet Intelligence Test. II. Psychological Principles Underlying the Binet-Simon Scale, and Some Practical Instructions for Its Correct Use. III. The Significance of Intelligence Tests for Mental Hygiene.* Reprinted from the *Journal of Psycho-Asthenics,* Vol. 18, Nos. 1, 2, 3, 1913-14. Pp. 20-33, 93-104, 119-127.

The author discusses the selection of children for the standards, the application of the tests, the question of age grouping, the percentage of correct responses necessary for locating a test, criteria for the elimination and substitution of tests, and the desirable number of tests per age group, and gives suggestions for extending and supplementing the scale. He further points out the limitations of the scale, weighs its reliability, indicates special sources of error, and considers the significance of various grades of mental retardation. Finally he shows that the use of the tests has served to draw attention to the degrees of deficiency in feeble-minded children, the desirability of isolating feeble-minded children from normal children, the tremendous range of individual differences in normal children, the weaknesses of the ordinary scheme of promotion in the grades, the development of differential psychology, the better understanding of the insane and of moral peculiarities and abnormalities, and the great need for specialists in mental development and mental hygiene in the schools.

J. ARTHUR THOMSON. *The Wonder of Life.* New York: Henry Holt & Co., 1914. Pp. xxi, 658. $3.50.

This is a magnificent popular survey of recent scientific studies in the development of animal life. In the introductory chapter on "The Drama of Life" the author gives a fascinating account of typical incidents in the struggle for existence. Chapter two deals with the haunts of life from the deep sea to the upper air. Chapter three gives an account of the way in which living creatures have utilized every portion of the earth's surface, and every kind of nourishment to contribute to the furtherance of organic existence. The next chapter deals with the modes of life and the types of animal behavior. Naturally, stress is laid upon striking manifestations of behavior, particularly the performances of the higher monkeys and the attainments of the lamented trained horses of Elberfeld. Chapter five, on "the Web of Life," discusses the so-called instincts, particularly those instincts having to do with social relationships as seen in ants, bees, birds and other animals. The cycle of life from birth through infancy to full development, decay and death is traced with illustrative material drawn from all fields of zoology. Finally, the author dwells upon the "Wonder of Life," with emphasis on the peculiar and striking characteristics exhibited by many types of living creatures. The splendid illustrations in color, mounted upon a dark gray background, give a most artistic and pleasing effect.

EDWARD L. THORNDIKE. *Educational Psychology—Briefer Course.* New York: Teachers' College, Columbia University, 1914. Pp. xii, 442. $2.00.

The present volume is a condensation and simplification for students in colleges and normal schools of the author's three volume work on educational psychology, published with the subheadings: "The Original Nature of Man," "The Psychology of Learning" and "Work and Fatigue and Individual Differences." Part one, dealing with man's original nature, discusses the characteristics of original tendencies, man's equipment of naive responses, the instincts, the capacity to learn, the neural basis of original tendencies and the value and use of these tendencies. Part two, dealing with the psychology of learning, develops the principles of learning from the slow modification of reactions in lower animals to associative learning in man, indicates the function of analysis and selection in learning, discusses the amount, rate, limit, conditions, changes and permanence of improvement, the influence of improvement in one mental function upon the efficiency of other functions, and outlines the essential aspects of mental fatigue. Part three deals with individual differences and their causes. Among the latter the author considers sex, race, family, maturity and environment, and refers briefly to individual differences in single traits and in combination of traits, such as types of intellect and character.

MAE C. TROVILLION. *Deficient Children.* Herrin, Ill. 1914. Pp. 75.

This is a thesis for the master's degree at the University of Indiana, prepared under the guidance of Prof. E. E. Jones, and de-

scribes the results of applying the Binet-Simon tests to a portion of the 1778 children in the grade schools of Bloomington, Ind. According to the author's results, 5.2 per cent. of these children are feeble-minded (retarded three or more years) and 10.2 per cent. are backward (retarded one or two years). If the experimental work was as inaccurate and "sloppy" as the text in which it is described, it is not worth attention. Thus we read that the first set of the Binet tests was put forth in *1903* and in *the* L'Annee Psychologique; that they have been tested, among others, by Dr. *Edward* B. Huey; that the author turned cloakrooms into *miniature* clinics; that Terman's conclusions *was* so and so; that M. W. Barr wrote a book entitled Mental *Deficiencies;* that one of the children tested had small, *slanting* eyes, etc.

ALICE SUMNER VARNEY. *Story Plays Old and New.* Book I, 175 pp; Book II, 174 pp.; Book III, 172 pp. Cincinnati: American Book Co., 1915.

These delightfully-constructed dramatic readers will be a great boon to teachers who are endeavoring to put life and force into their teaching of oral reading. Pupils who read these books aloud with animation can scarcely fail to develop a considerable fluency and mastery of details in oral reading.

WILLIAM A. WHITE. *The Unconscious.* Reprinted from the Psycho-Analytic Review, Vol. II, No. 1, January, 1914. Pp. 12-28.

The author holds that the unconscious is our historical past and serves as the regulator and balance wheel of our present consciousness. "The unconscious, then, is like the tail of a kite. While it drags down and holds back, it nevertheless steadies its flight, and prevents its being dashed to pieces by a sudden dash downward, and makes it possible for it to reach greater heights." In order to understand and appreciate the significance of the unconscious we must include in our study not only the individual consciousness, but race consciousness with all of the curious modifications of tradition and superstition.

ROBERT M. YERKES AND J. W. BRIDGES. *The Point Scale: A New Method for Measuring Mental Capacity.* Reprinted from the Boston Medical and Surgical Journal, Vol. 171, No. 23. December 3, 1914. Pp. 857-866.

The point scale is a development of the device suggested by Dr. E. B. Huey, and represents a decided advance upon the Binet Scale in two respects. First, every test is to be applied to each subject; second, not only does the test call for the judgment "passed" or "failed," but there is a quality estimate of the performance which is indicated by the number of points obtained. The point scale is easily applied, and lends itself to a much more accurate and flexible diagnosis of individual perculiarities than the Binet Scale. A detailed description of the method, with a report of its application to one thousand individuals, is soon to be issued in book form by Warwick & York, Baltimore.